# GEOGRAPHY 6

Based on Single National Curriculum 2022

Punjab Curriculum and Textbook Board, Lahore

بِسۡمِ اللّٰہِ الرَّحۡمٰنِ الرَّحِیۡمِ

(In the Name of Allah, the Most Compassionate, the Most Merciful.)

# GEOGRAPHY

6

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Based on Single National Curriculum 2022

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PUNJAB CURRICULUM AND
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Unit 1

# STRUCTURE OF EARTH AND TYPES OF ROCKS

**Student's learning outcomes:**

**After completing this lesson, the students will be able to:**

- Define Geography.
- Describe the internal structure of the Earth.
- Differentiate between three layers of the Earth.
- Explore the theory of tectonic plates.
- Identify different types of rocks.
- Explore the process of the rock cycle in the formation of rocks.
- Discover the uses of rocks.
- Identify the most commonly found rocks in Pakistan.
- Describe the importance of rocks in the economy of the region.
- Describe the main features of modern techniques in geography (GIS, GPS, Google Maps etc.).

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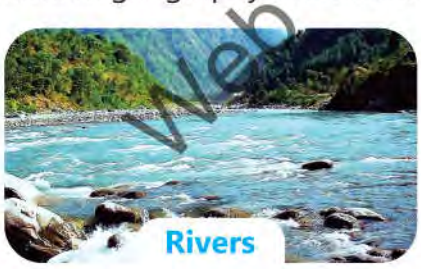
The word "Geography" is a combination of two words, Geo and Graphy. Geo means Earth and Graphy means Description. So, Geography means "Description of the Earth". In addition to that the study of overall surroundings of physical and human environment is called geography. Modern geography studies the Earth as the home of man. It attempts to find out the relationship



between man and his environment. In other words, it studies man's adoption to the environment, in which he lives and works.

***"Geography is the science of places."***

***"Geography is a scientific or systematic study of aerial variations and similarities from place to place on the surface of the earth."***

## INTERNAL STRUCTURE OF THE EARTH

Information about internal structure of the Earth is limited. The distance between Earth's surface and its Centre is 6371 km. Scientists take help from earthquake waves, magnetic force of the Earth and gravitational force to get information about internal structure of the Earth. The information from the said sources revealed that internal structure of the Earth is composed of three layers i.e. Crust, Mantle and Core.

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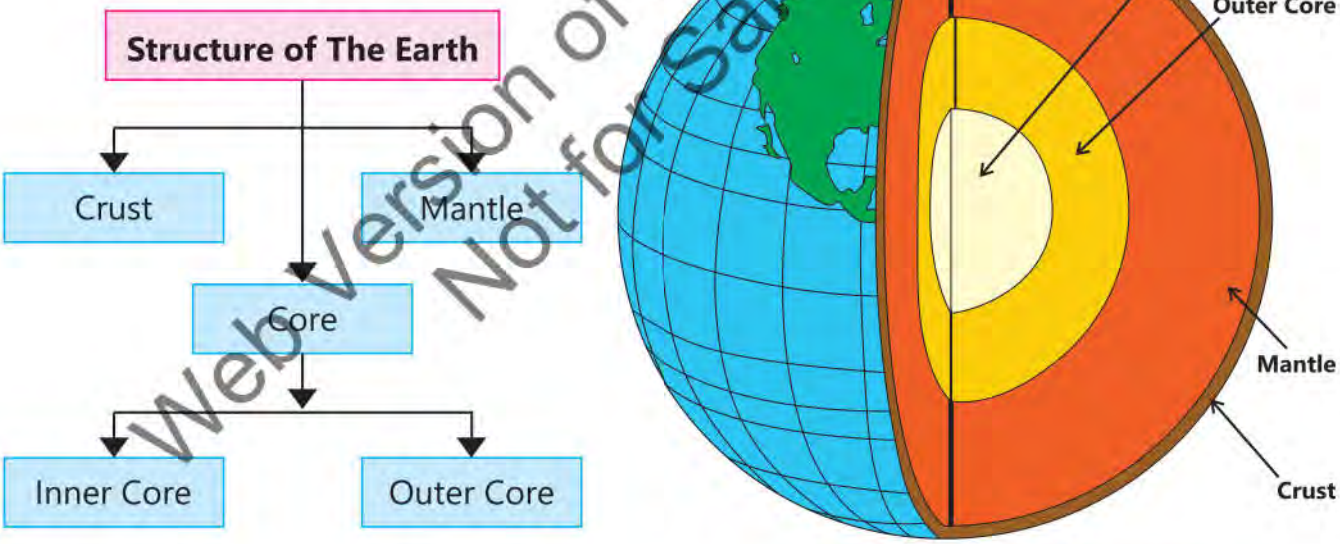



**Earth's Internal Structure**

### Earth's Crust

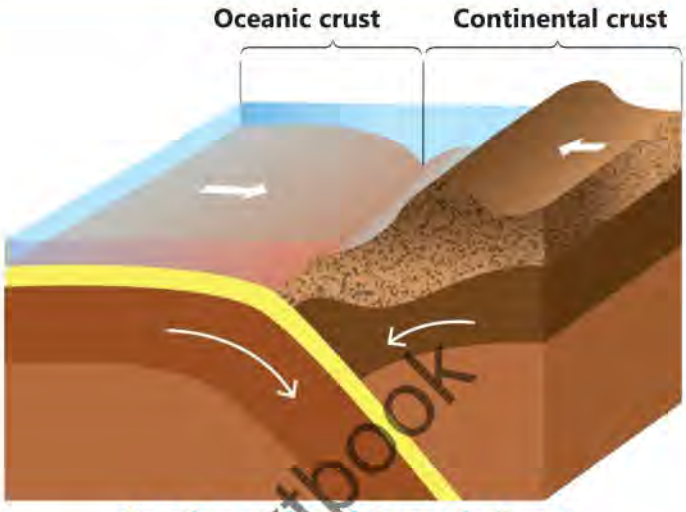
Outer most part of the Earth at which oceans and continents exist is known as Earth's crust. Its depth varies from about 16 km to 40 km due to uneven distribution of physical features on the Earth. It is further divided into two main parts i.e. continental crust and oceanic crust.

**Continental Crust**

It consists of various land masses known as continent. It is comprised of silicon and aluminium so also known as Sial. Its maximum depth is about 40 km.

**Oceanic Crust**

Invisible part of Earth crust under oceanic water in form of ocean bed is called oceanic crust. Its depth is about 8 km. It contains silicon and magnesium and is named as Sima.



Continental and Oceanic Crust

## Mantle

The central layer of the Earth after earth crust is mantle. Its depth is around 2900 km. Upper part of mantle is in molten form whereas the lower mantle is solid. The temperature of upper mantle is about 2000°C while the temperature of lower mantle is about 3000°C. Although the temperature of lower mantle is higher than the upper mantle but it is in solid form due to higher pressure of upper mantle and crust.

## Core

It is the innermost layer of the Earth. It is divided into two parts, the outer core and inner core. Its upper part (outer core) is in liquid form and its depth is about 2250km and its temperature is about 3800°C. Its lower part (inner core) is in solid form and its depth is about 1220km deep. Its average temperature is about 5200°C. It contains the rocks of iron and nickel and also known as Nife.

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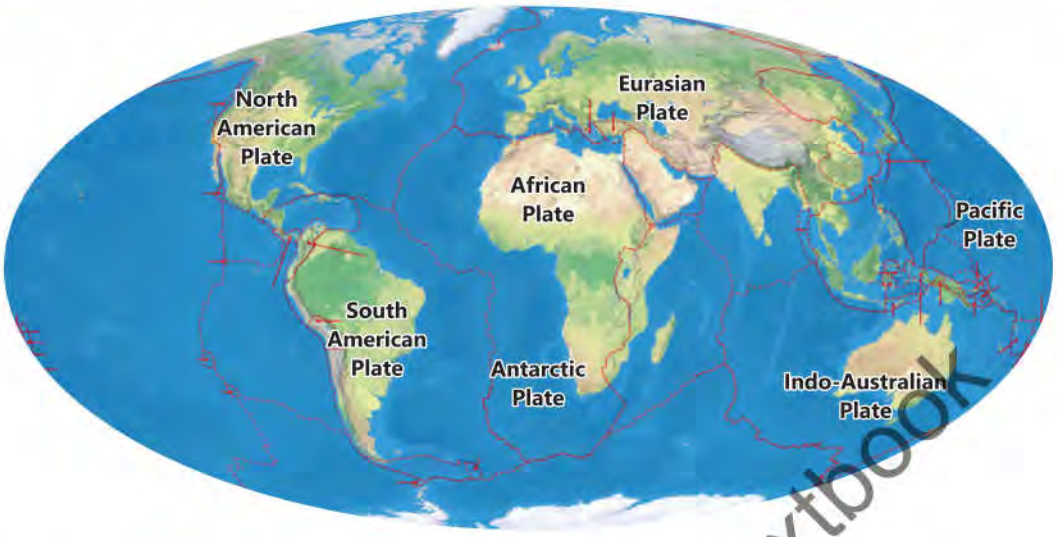
# TECTONIC PLATES

All the continents were like a giant super continent. Millions of years ago that was named as "Pangaea" by a scientist named Wegener. Pangaea was divided into smaller pieces (plates) and adopted the form of present continents due to internal movements of the Earth. The crust is divided into following seven major plates and many other minor plates.

- **Pacific Plate**
- **African Plate**
- **Eurasian Plate**
- **North American Plate**
- **South American Plate**
- **Indo-Australian Plate**
- **Antarctic Plate**

Earth's Crust is solid that is floating at the upper part of mantle that is called molten. Hence, these plates are not static but always remains in motion.



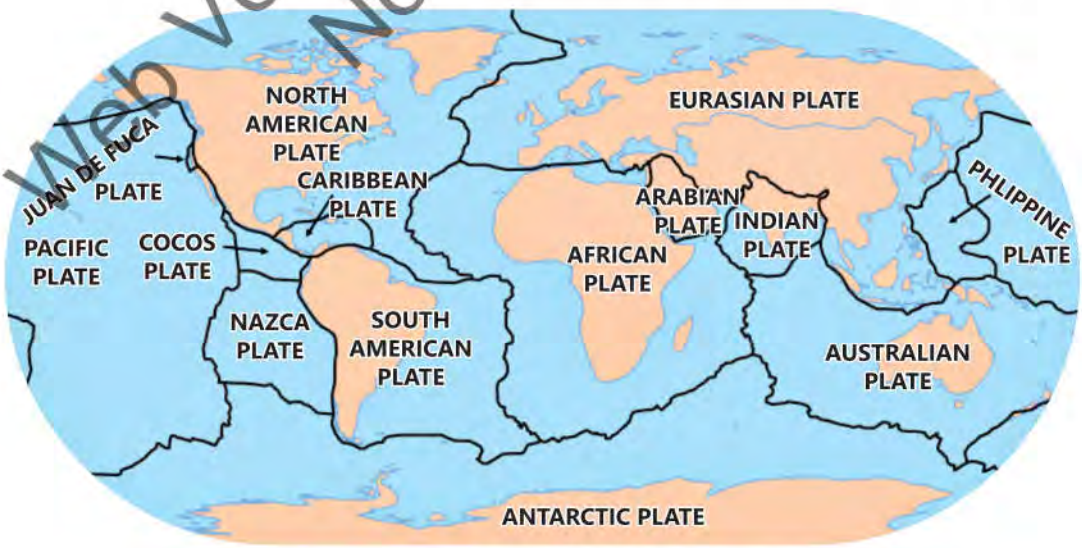

Major Tectonic Plates

**Activity Corner!**

Put a piece of paper in a tub full of water. Observe, how does the paper act if tub shakes.

## Faults (Tectonic Plates Boundaries)

The cracks between the Earth's plate are known as faults. Earth's crust was divided into various plates because of these faults. These plates move continuously as they are floating at molten rocks. A crack on the Earth's crust is created due to the movements of the plates which is called fault. This process starts in such areas where earth's crust is weak. Such areas are called fault zones. These movements produce faults. The formation of the faults has following types:




Major and Minor Tectonic Plates

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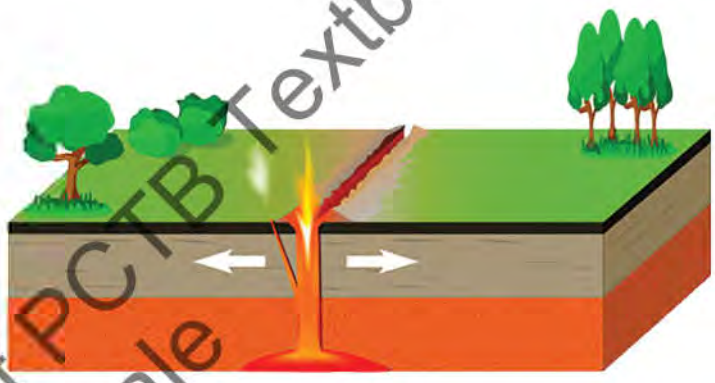
### i. Convergence Plate Fault

The movements of tectonic plate towards each other is termed as convergence plate fault. A massive plate movement is observed in the areas of convergence zone.

Convergence Plates

### ii. Divergence Plate Faults

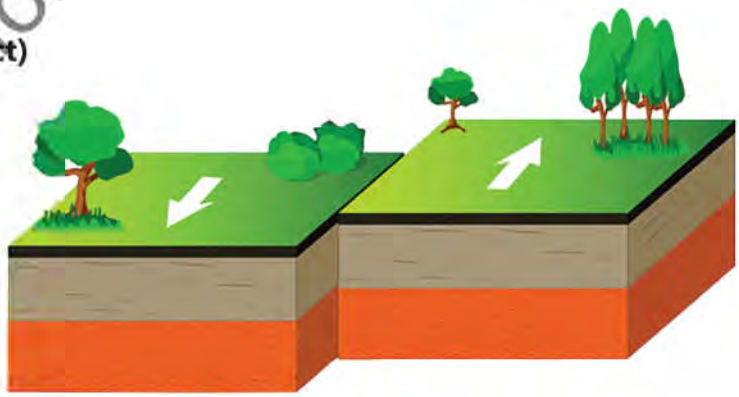
Sometimes, tectonic plates move away from each other and this process is called as divergence plate faults. This causes the emergence of lava from weaker parts of the earth's crust. This process is known as volcanism. The ridges inside the oceans are formed as a result of this type of activity.



Divergence Plates

### iii. Transform Faults (Lateral Plate Contact)

In this type of plate movement the plates slide away with each other which is known as transform fault. Best example of such fault is San Andreas Fault in Western USA.



Transform Fault

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## Convergence, Divergence and Transform

All of these three movements may be harmful because faults are developed in different parts of the Earth's crust that may be several kilometres deep. These cracks are the natural boundaries in between different tectonic plates that may be seen in the form of folded mountains, volcanic mountains and centers of earthquakes.

**Do You Know?**

Pacific plate is surrounded by volcanic mountains from all sides. Maximum volcanic activity is observed in this region because faults are present on all sides. Therefore, that region is known as Pacific Ring of fire.

## MAJOR FAULTS IN PAKISTAN

Pakistan is located at place where two important tectonic plates (Eurasian and Indo-Australian) collide with each other. These plates are moving towards each other, so they form high mountains in the northern areas of Pakistan. The fault line separates Eurasian plate and Indo-Australian plate, therefore, it is an important zone of earthquakes. The fault lines are stretched east- west as well as north - south.

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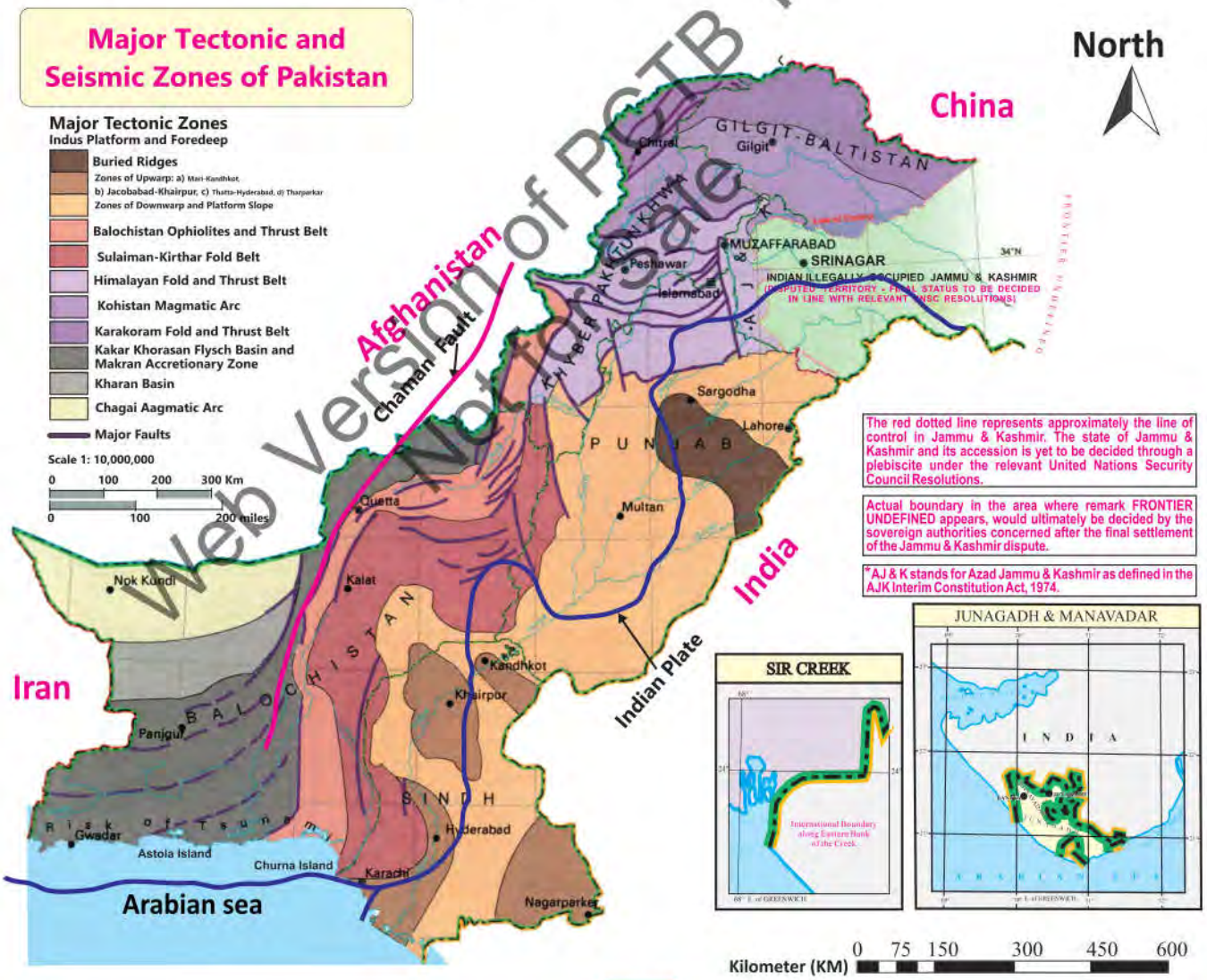
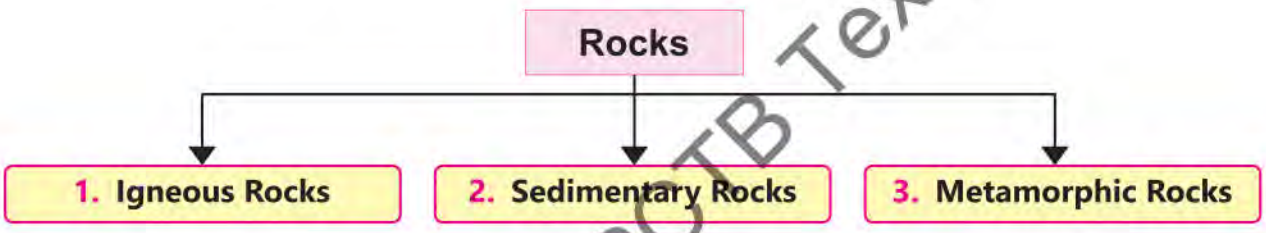


**Do You Know?**

The disastrous earthquakes in the history of Pakistan were observed in 1935 and 2005 which resulted in casualties of thousands of people. Both of these earthquakes were the result of plate movements.

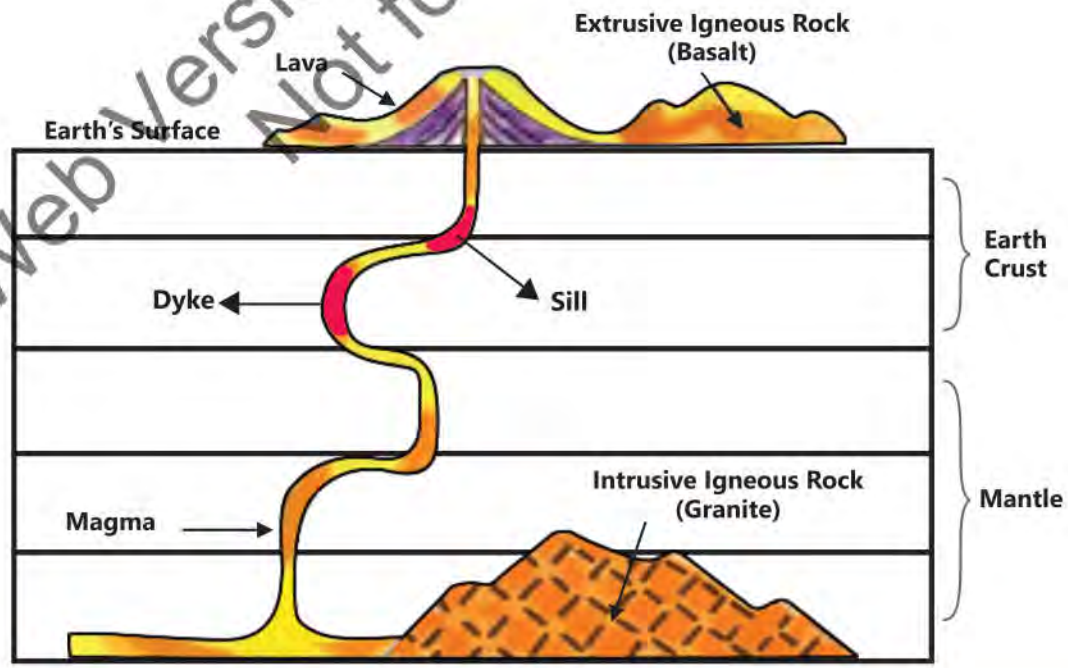
## ROCKS

Rock is an aggregate of minerals that may be hard like granite or soft like chalk. Earth crust is made of rocks. Some rocks have crystals, some have animal and plant fossils while some absorb water. Rocks are found in different colours. Rocks are classified into different types because of their formation. Basic types of rocks are as follows:




### 1. Igneous Rocks

Igneous rocks are formed by the solidification of molten material (lava) and magma in and outside the surface of the Earth. These are also known as primary rocks because these rocks are the




Igneous Rocks

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earliest which came into being. There are two main types of igneous rocks on the basis of lava and magma to solidify. Going into the interior of the Earth, the temperature increases.

### Types of Igneous Rocks

The molten matter moves under the surface of the Earth. This molten matter solidifies either deep inside the Earth or near its surface (magma) and sometimes on the surface of the Earth (lava). According to their formation, there are two types of igneous rocks.

i. Intrusive Igneous Rocks

ii. Extrusive Igneous Rocks

**i. Intrusive Igneous Rocks**

Intrusive igneous rocks are formed by solidification of magma in cracks beneath earth's surface. If the magma solidify in vertical cracks it is called dyke and if solidify horizontally in cracks it is called sill. Gabbro, Diorite and Dolerite are some examples of intrusive igneous rocks.

Gabbro

Diorite

Dolerite

**ii. Extrusive Igneous Rocks**

Extrusive igneous rocks are formed by solidification of lava at the Earth's surface. Temperature at the Earth's surface is low as compared to interior of the Earth, so lava solidifies immediately. Basalt and obsidian are its best examples.

Obsidian

Basalt

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| Commonly Found Igneous Rocks in Pakistan | |
|---|---|
| Obsidian | Chaghi (Balochistan) |
| Basalt | Ranikot (Sindh) |
| Gabbro | Zhob (Balochistan) |

**Do You Know?**

Continents are formed by granite and ocean floors are formed by basalt rocks.

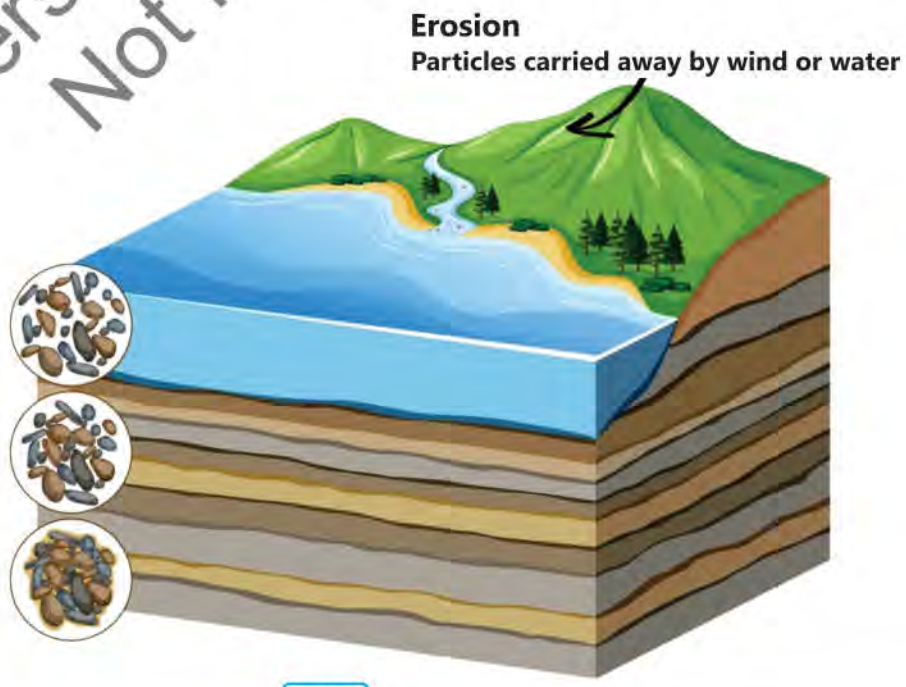
### Characteristics of Igneous Rocks

- Igneous rocks were formed in the beginning, that is why these are also called primary rocks.
- Crystals are found in these rocks.
- There are no layers in these rocks.
- These rocks are hard.
- Fossils of animals and plants are not found in these rocks.

## 2. Sedimentary Rocks

These rocks are formed on the surface of the Earth by the weathered and eroded material (sediments) called sedimentary rocks. Heat, rain, wind, river and glaciers are the main agents in the formation of sedimentary rocks. These sediments are transported to far off places and deposited layer by layer. These layers fix together firmly with the passage of time and a rock is formed which is called sedimentary rock.

**Formation of Sedimentary Rocks**

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These rocks have minerals as well as biological and vegetative remnants, so it may be classified into three types.

**a.** Inorganic Rocks (Clastic Rocks)

**b.** Organic Rocks (Non-Clastic Rocks)

**c.** Chemically formed Rocks

**(a) Inorganic Rocks (Clastic Rocks)**

Such rocks consist of metallic particles, minerals and rock material. For example, boulders, cobbles, pebbles and sandstones etc. are extensively found. This material is transported and then deposited by different geomorphic agents (wind, water, glacier) which is ultimately converted into rocks. Huge and massive mountain ranges all over the world consist of these rocks. The examples of these rocks are given below:

- Limestone
- Shale
- Sandstone
- Conglomerate
- Breccia

Limestone

Breccia

Sandstone

Shale

**(b) Organic Rocks (Non-Clastic Rocks)**

Such rocks consist of fossils of animals and plants. Rocks made by the animal fossils are called calcareous rocks (for example, limestone) whereas the rocks made by the fossils of plants are named as carbonaceous rocks (for example, coal).

Peat

Lignite

Anthracite

Bituminous Coal

**(c) Chemical Rocks**

These rocks are made in result of some chemical process. For example, water deposits different types of salts on the surface of the Earth, after evaporation. Deposits of such salts form chemical rocks.

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This material carried away by water and deposited in lakes or in the depressions. This process keeps on going and a thick layer of salt emerges. Such rocks are known as chemical rocks.

Gypsum

Rock Salt

**Do You Know?**

Rock salt, gypsum and dolomite are some important examples of sedimentary rocks. In Pakistan, huge reserves of such rocks are found in Salt Range, Dera Ghazi Khan and Daud Khel.

### Characteristics of Sedimentary Rocks

- The outer surface of the Earth is formed mostly of sedimentary rocks.
- These rocks are identified easily because of their layered form.
- These rocks are mostly used in construction works.
- Fossils of animals and plants are found in these rocks.
- These rocks are comparatively soft and absorb water.

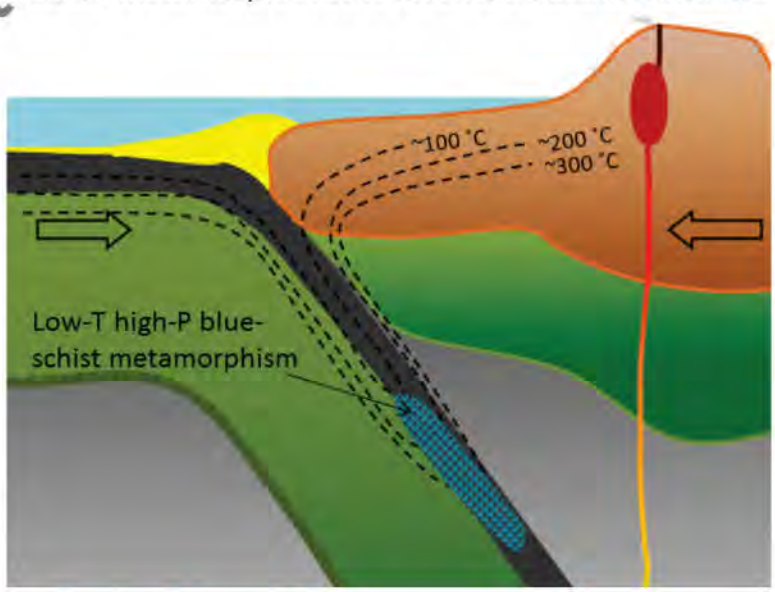
## 3. Metamorphic Rocks

When igneous or sedimentary rocks change their physical and chemical properties due to extreme temperature and high pressure are called metamorphic rocks which are classified into two main types.

**Regional Metamorphism**

The crust is divided into multiple plates. Heavier plate comes under the lighter plate due to convergence. Rocks change their chemical and physical properties due to high temperature and pressure. This process is named as regional metamorphism.

Earthquakes are also a cause of regional metamorphism.




Heavier plate under high temperature and pressure.

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Shale is a sedimentary rock that has become slate after metamorphism. Regional metamorphism occurs over a vast area.

Slate

**Contact Metamorphism**

This metamorphism is directly associated to volcanism. Here rocks change their physical and chemical properties due to extreme temperature when magma inside of the Earth tries to come outside the earth's surface cracks.

Marble is an example of this phenomenon that was limestone (sedimentary rock) before changing its characteristics. Sandstone also metamorphized into quartzite. Diamond is the hardest metamorphic rock in the world.

### Characteristics of Metamorphic Rocks

- These rocks are formed by the alteration of pre-existing rocks.
- These are smoother and shiny.
- These rocks are harder and compact.
- Fossils of animals and plants are not found in these rocks.

**Activity Corner!**

Use available sources such as maps, google maps or GIS to understand structure of Earth and rock formation.

## ROCK CYCLE

It is a process of making and breaking of rocks. In this process, weathering and erosion breaks the rocks and agents like river, winds and glaciers, etc. redeposited the weathered and eroded material and rocks are formed.

**Do You Know?**

The rock cycle describes the processes through which the three main rock types (igneous, metamorphic, and sedimentary) transform from one type into another.

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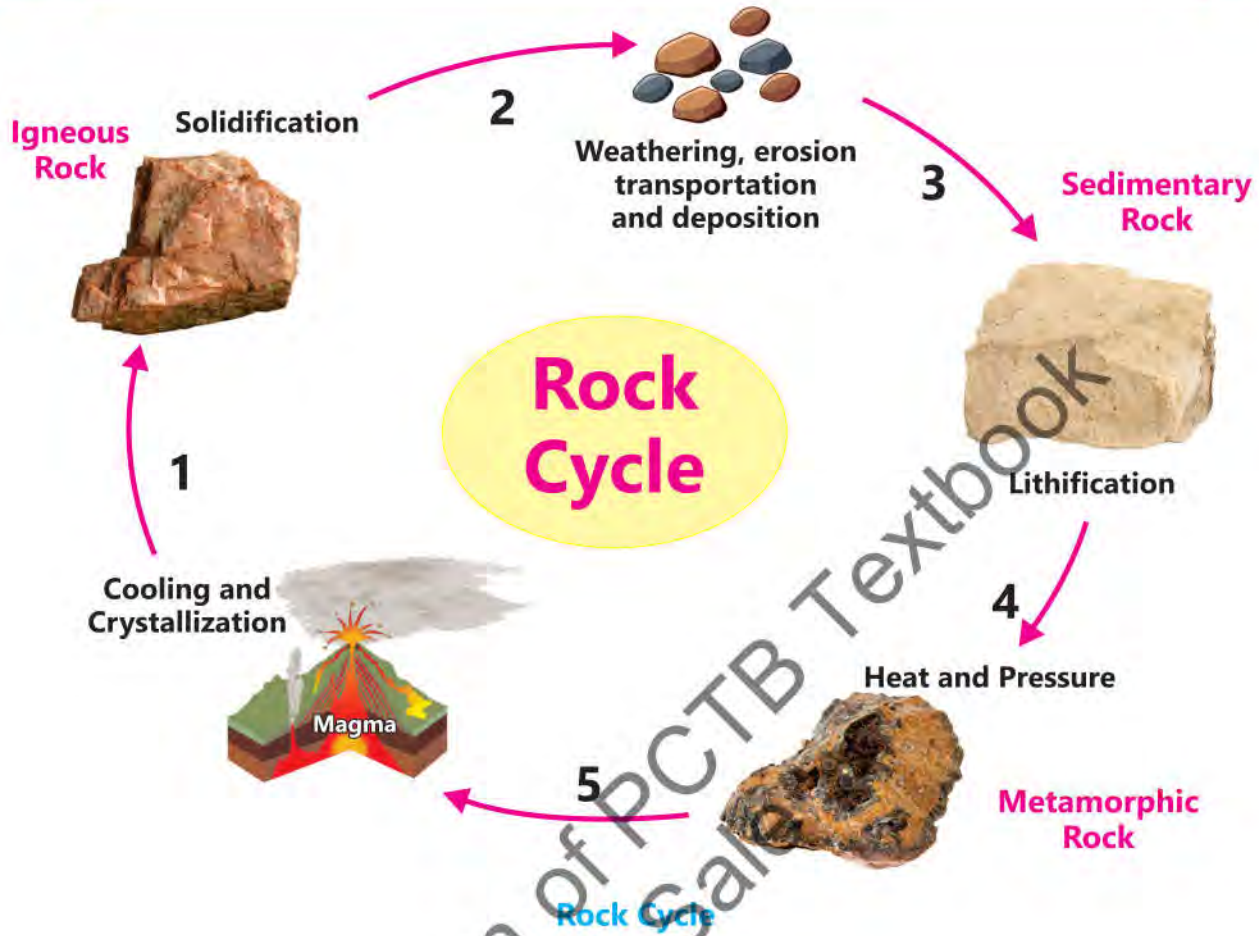


Rock Cycle

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## USES OF ROCKS

Some uses of rocks are mentioned below:

**i. Cement Industry**

The rocks like gypsum and limestone are used in cement industry. Gypsum is also used in fire extinguishers.

**ii. Salt in Daily Life**

It is an important mineral used to make medicines, bleaches and soaps. It is also used for food preservation. Rock salt is also the part of our meal.

**iii. Educational Institutions**

Chalks is traditionally used in educational institutions where markers, pens and white boards are not available.

Education

**iv. Decoration and Utensils**

Marble is used in buildings and mosques. Melting of quartz results in making of glass that is used in buildings and making utensils and mirrors.

**v. Industries**

Coal is used in different industries for example, construction, automobile industry, making utensils and different machineries manufacturing.

**vi. Jewelry and Coins**

Diamond is an expensive mineral used for decoration and jewelry.

Jewelry

Fire Extinguisher

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## ROLE OF ROCKS IN ECONOMY

Economy of any country or region is based on types of rocks found there because rocks have major influence on the economy. The main points of economic importance of rocks are given below:

**i. Source of Fuel**

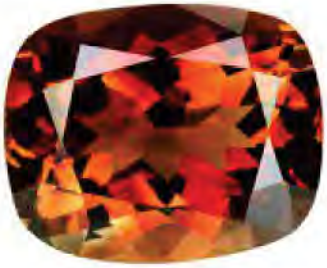
Fossil fuels are found in sedimentary rocks only. These resources are used in different sectors. For example, power generation, transportation, electricity and in factories.

**ii. Jewelry**

Gemstones are highly demanded for jewelry making. Such expensive stones are found in

Sapphire Stone

Moonstone



Topaz Stone

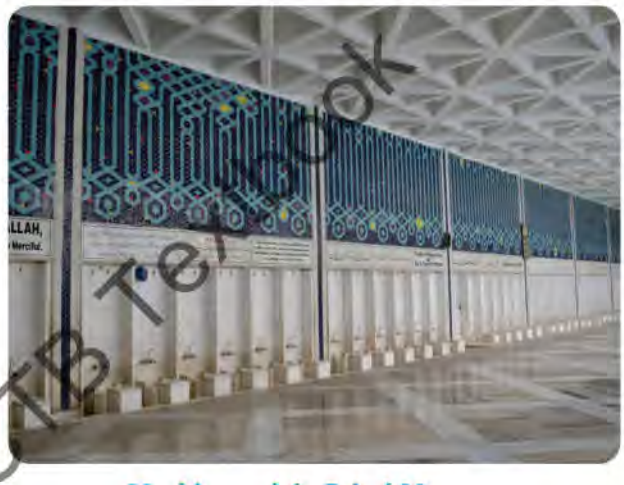
igneous as well as metamorphic rocks. Some of the famous gems are sapphire, ruby, diamond, topaz, moonstone and emerald etc.

**Do You Know?**

Diamond is the hardest and the most expensive gemstone. Industrial diamonds are used for cutting and grinding.

**iii. Building Material**

Rocks are the main source of building materials. Such materials are used for construction of houses, dams, buildings and roads. For example, marble is used for decoration in modern houses, graveyards and mosques. Granite tiles are also used in buildings.



Marble work in Faisal Mosque

**iv. Minerals**

Metallic and non metallic minerals are important source of income for any country. Gold, copper, iron ore, silver, lead, zinc, uranium and manganese etc. have vital economic importance. All of these minerals are originated in different types of rocks.

**v. Soil**

All of the rocks are ultimately disintegrated into different types of soil particles. Alluvial soil like in the plains of Pakistan and India is the best for lowland crops.

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## ROCKS FOUND IN PAKISTAN

All three types of rocks found in Pakistan, are rich in metallic and non-metallic minerals. Pakistan has huge reserves of salt, marble, china clay, shale, sandstone and limestone. Some extensively found rocks of Pakistan are as follows:

### Salt

Pakistan is blessed with millions of tons of rock salt reserves. The largest reserve of rock salt is in Khewra (Jhelum). Other huge reserves include Kalabagh (Mianwali), Warcha (Khushab) and Bahadur Khel (Karak-KP). Sea Salt is obtained from Lasbela and Makran coast in Balochistan and Maripur (Karachi) in Sindh.

### Limestone

Limestone is a type of sedimentary rocks which is mostly found in northern and western

mountainous areas of Pakistan. Its major reserves are in Daud Khel, Wah and Dera Ghazi Khan (Punjab), Rohri and Hyderabad (Sindh), Kohat and Nowshera (KPK) and Sibbi and Khuzdar (Balochistan).

Rocks found in Pakistan

## Coal

Coal is found more or less, in all provinces of Pakistan. Thar (Sindh) has the largest coal reserve. Best quality coal is produced in Balochistan. Potowar Plateau (Punjab) and Hungu (KPK) are other coal producing areas of Pakistan.

## Sandstone

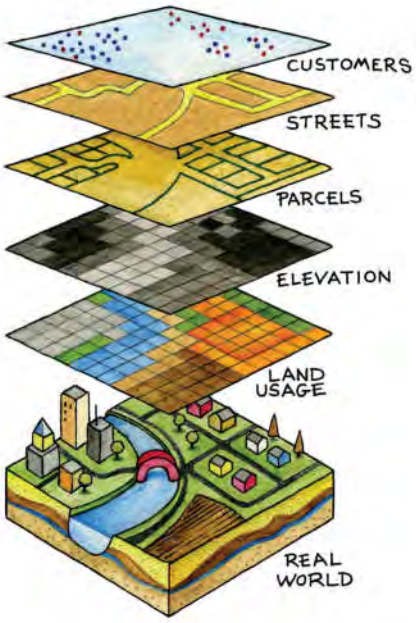
Sandstone is a type of sedimentary rocks. Murree hills in Pakistan are located in the south of Himalayas that are composed of sandstone.

## Marble

Marble is a type of metamorphic rocks. It is found in different areas of Pakistan which include Mardan, Nowshera, Swat, Hazara, Gilgit and Attock.

# MODERN TECHNIQUES IN GEOGRAPHY

The world is heading towards new inventions and discoveries every day. There are many innovations in the field of geography just like other fields. Some major developments are as below:




## Geographical Information System (GIS)

GIS is computer-based approach to capture, store, manipulate, analyze and display geographical information. It was introduced in 1992 by United States Geological Survey. GIS provides the foundation of digital mapping. Therefore, digital mapping is being done by using GIS.

**Do You Know?**

The field of map designing is known as cartography and the person who designs maps is called cartographer.

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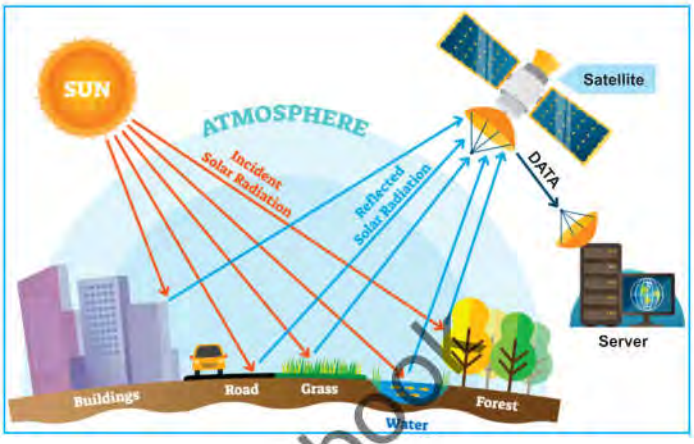
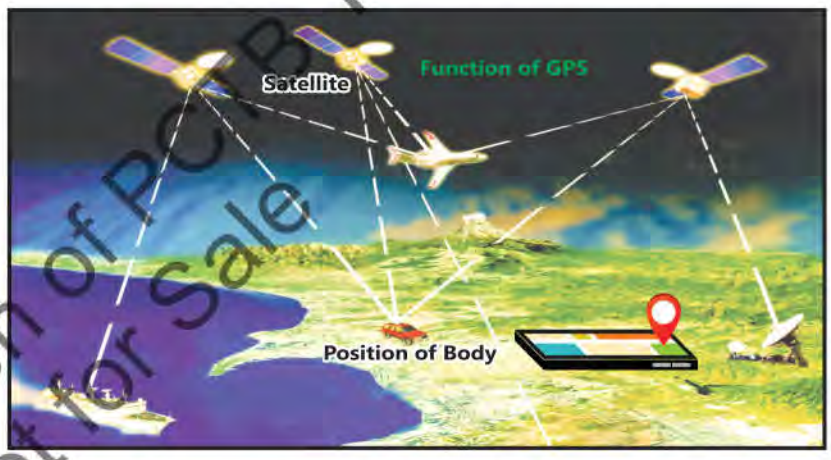
## Remote Sensing (RS)

Remote sensing is a monitoring of physical properties of any area through radiations. Useful information is collected by satellites in the form of images. These images are then processed to extract required information using GIS. Introduction of remote sensing in the field of geography has made easier to study inaccessible areas.




## Global Positioning System (GPS)

GPS help people in positioning and travelling. Signals from different satellites are received on the Earth by different control stations. The user receives that information through a device. GPS has brought revolution in the field of communication. It is extremely helpful for tracking companies, travelers, army, navigators and tourists.




## Google Map

It is another internet-based utility that provides information about different sites, road network, traffic conditions and different geographical regions. It is easily accessible through smart phones. Google map is highly beneficial for emergency services, delivery boys and travelers.

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## Key Points

- Geography is a field in which Earth's surface, climate, man, its activities and behaviours are studied.
- The distance in between earth's surface and its center is 6371 km.
- All of the continents were like giant super continent millions of years ago this great continent was named as Pangaea.
- The huge cracks on the earth surface are known as faults.
- Some rocks have crystals, some have animal and plant fossils while some absorb water. Rocks are found in different colours.
- Igneous or sedimentary rocks change their physical and chemical properties due to extreme temperature and high pressure are called metamorphic rocks.
- Melting of quartz results in making of glass that is used in buildings and making utensils and mirrors.
- Limestone is mostly found in northern and western mountainous areas of Pakistan.

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## Exercise

**1 Circle the correct option:**

i. The distance in between Earth's surface and its centre is:

a. 12757 km  b. 6371 km  c. 40225 km  d. 40275 km

ii. Average temperature of inner core is:

a. 2000 °C  b. 3000 °C  c. 4000 °C  d. 5000 °C

iii. Ring of fire is located in:

a. Indian Ocean  b. Atlantic Ocean  c. Arctic Ocean  d. Pacific Ocean

iv. Marble is an example of type of rock:

a. Igneous  b. Metamorphic  c. Sedimentary  d. Organic

v. Rocks that have changed their properties due to pressure and temperature are called:

a. Sedimentary Rocks  b. Metamorphic Rocks

c. Igneous Rocks  d. None of these

## 2 Answer the following short questions:

i. Write the names of important layers of the Earth.
ii. Write a short note about global positioning system (GPS).
iii. Enlist the names of the major tectonic plates in the world.
iv. Enlist the names of the commonly found rocks in Pakistan.
v. Differentiate between extrusive igneous rocks and intrusive igneous rocks.
vi. Write the characteristics of sedimentary rocks.

## 3 Answer the following questions in detail:

i. How minerals are important for the economy of any country?
ii. Which types of rocks are located in Pakistan? Discuss their distribution.
iii. What do you know about internal structure of the Earth?
iv. Discuss modern techniques in the field of geography.

## Critical Thinking Questions:

- Explore the impacts of modern technology in geography.
- How rock cycle occur?
- Why rocks are important for us?
- How we can compare the Earth with egg?

## Learning Activities:

**The Teacher will:**

i. Use presentations, diagrams, and videos to explain the layer structure of the Earth.
ii. Make a chart and show rock cycle on it.

## Project for Students:

- Make a model of the Earth's internal structure.

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Unit 2

# MOUNTAINS, PLATEAUS AND VALLEYS

## Student's learning outcomes:

**After completing this lesson, the students will be able to:**

- Identify different types of mountains.
- Explain the formation of different types of mountains.
- Discover the major types of mountains in Pakistan.
- Describe the importance of the Himalayas, Karakoram and Hindukush Mountains.
- Explain the reasons for frequent earthquakes in Pakistan.
- Differentiate between a plateau and a mountain.
- Differentiate between V-shaped valleys and U-shaped valleys and their formation.
- Describe rift valley and explore where it is located.
- Identify some major valleys in Pakistan.
- Compare the lifestyles of people living in mountains, plateaus and valleys.
- Describe the importance of the Himalayas in the geography of Pakistan.

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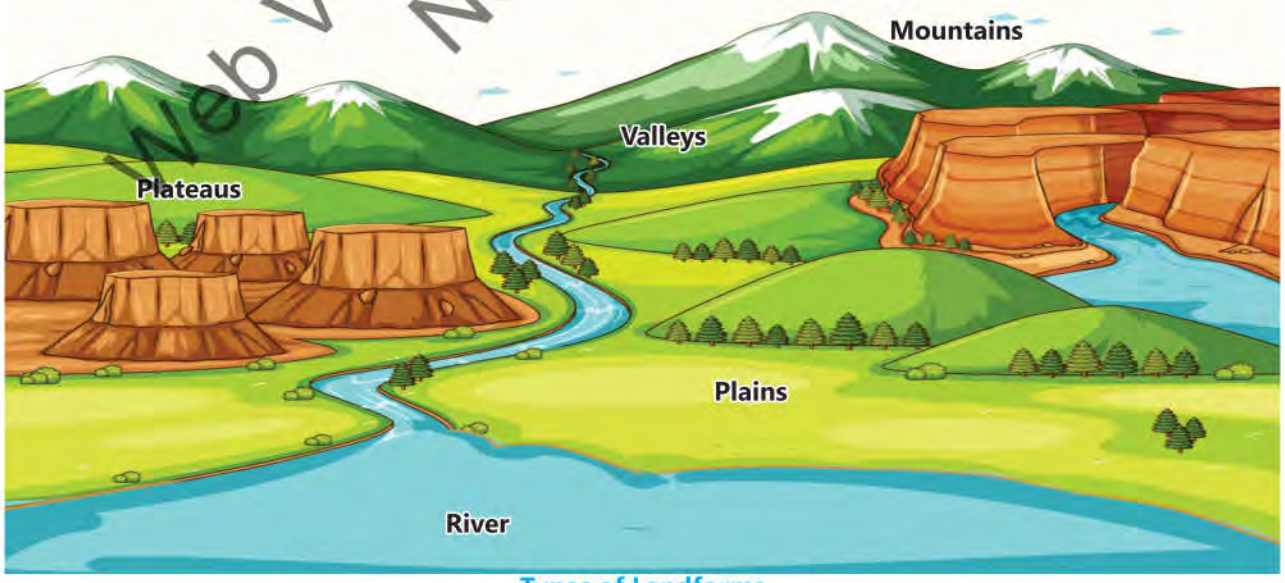
The surface of our Earth is not homogenous. A variety of landforms can be seen on it. There are elevated portions in the form of mountains, table land like features which are called plateaus




Types of Landforms

and vast stretches of flat land in the form of plains. Even the sea floor is comprised of uneven surface.

Landforms are formed by two forces:

i. Internal forces of the Earth

ii. External forces of the Earth

Let us look at both of them:

### 1. Internal Forces of the Earth

There are forces inside the Earth which push a part of Earth upwards or downwards. These forces create new landforms on the surface of Earth. The continents and mountain ranges are formed by these forces.

In the same way, when the molten matter inside the Earth moves upwards, it comes out on the surface of the Earth and solidifies. A variety of landforms are created in this way i.e., volcanoes and plateaus.

### 2. External Forces of the Earth

Have you seen a sculpture working? He works on stone with his tools and carves out different features. In the same way, when a part of Earth is uplifted by the internal forces, winds, rivers, glaciers and sea waves carve out different features on it. These are the external forces of the Earth. Dissected coast lines, valleys, mountains, various plateaus and plains etc. are formed by these forces.

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## MAJOR LANDFORMS

### Mountains

Mountains are the most prominent landform as per their height, volume, size, shape and area. A landmass on the Earth surface with rocky, uneven, sloppy and elevated surface is known as mountain.

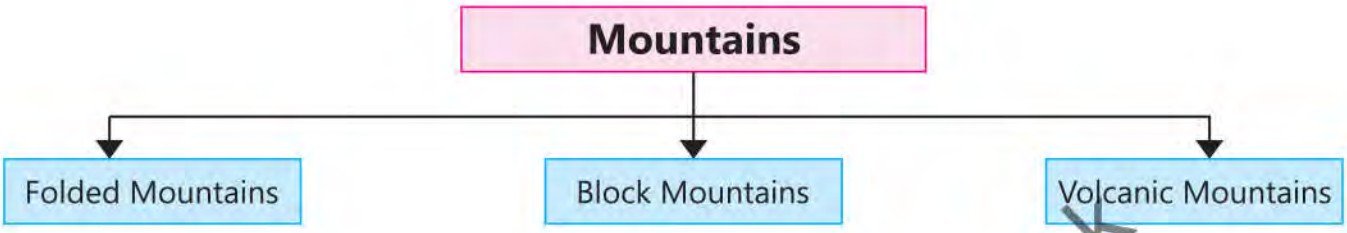
**Do You Know?**

Elevation of mountain is at least 900 m or above from sea level. Similar feature with less than standard elevation is referred as hill. The highest point of the mountain is known as peak.

Mountains have diverse structure. Some are dome like, while others are vertical like a wall. Some of the mountains are conical with conic peaks. Mountains are generally found in the form of ranges, for example, Rockies (North America) and Himalayas (Asia). Mountain ranges all over the world e.g. Himalayas (Asia), Rockies (North America), Andes (South America) and Alps (Europe) are made by sedimentary rocks. They all are rich in animal and plant fossils. These ranges are folded mountains. They have folds because of internal movements of the Earth.

## TYPES OF MOUNTAINS

There are three broad types of mountains according to their formation.

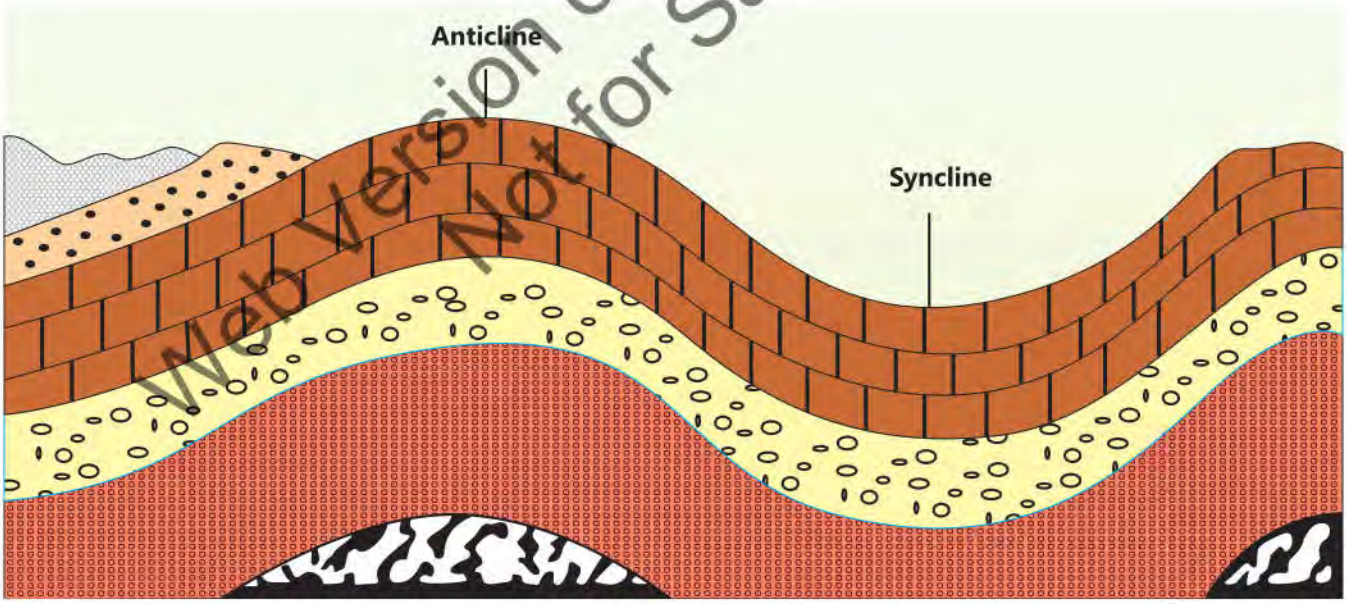



### 1. Folded Mountains

The convergence of the tectonic plates produce folds. The mountains formed in this way are called folded mountains. Upper part of the fold is called anticline while the lower one is syncline. Folded mountains all over the world are stretched in the form of parallel and huge ranges. Himalayas, Rockies, Andes and Alps are main examples of such mountains.

**Skill**

What is the difference between mountain range and mountain peak?




**Do You Know?**

Himalaya is among the highest mountain range where world's highest peak i.e. Mt. Everest (8848 m high) is located.

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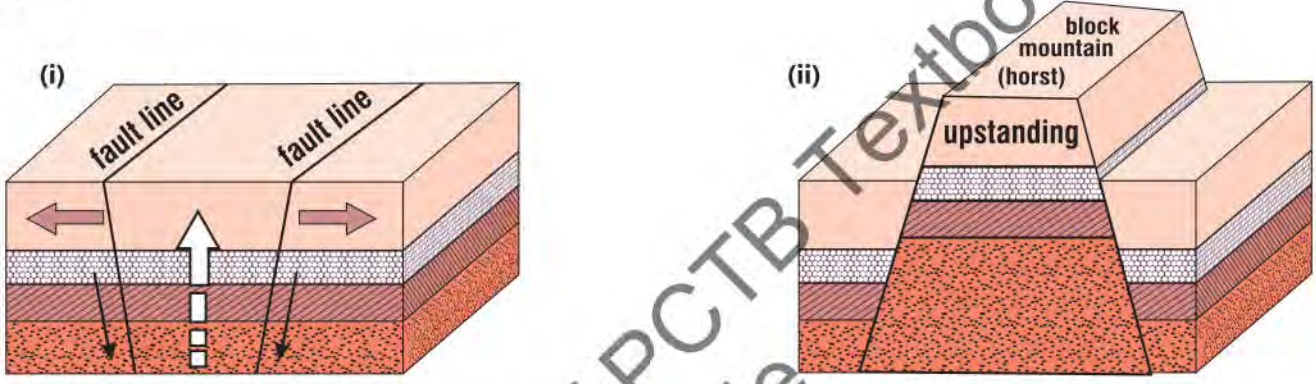
## 2. Block Mountains

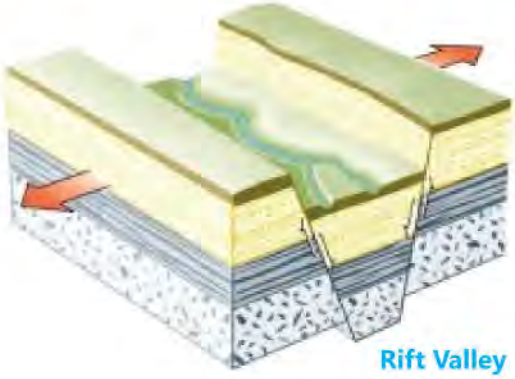
Earth's crust is cracked due to divergence that divides the surface into various blocks. Unequal stresses and earthquakes create faults on the surface of the Earth. Sometimes the internal forces uplift a part of the Earth between these faults which become higher from the surrounding surface. It is called Block mountain.If any of the block is uplifted during this process, that is known as block mountain, for example, Harz Mountains (Germany). In between block of the Earth crust is uplifted in some cases that is called horst. If that block is upended, it makes rift valley also named as graben.




(a) Block Mountain (Horst) formed by vertical movements of the Earth

**Rift Valley**

A feature associated to block mountains is rift valley. This type of valley is formed when the Earth's crust on both sides of two parallel faults is uplifted or sinks. Well known rift valleys in the world are African Rift Valley and Great Basin of USA.



Rift Valley

## 3. Volcanic Mountains

Lava accumulates and then solidifies vertically and horizontally at the Earth's surface. This process continues and keeps increasing its size unless it takes conical shape known as volcanic mountain. Volcanic mountains are formed by successive layers of lava. Vesuvius (Italy) and Fujiyama (Japan) are some famous volcanic mountains in the world. There are three types of volcanic mountains:

- Cinder Cone Volcanoes
- Composite Volcanoes
- Shield Volcanoes

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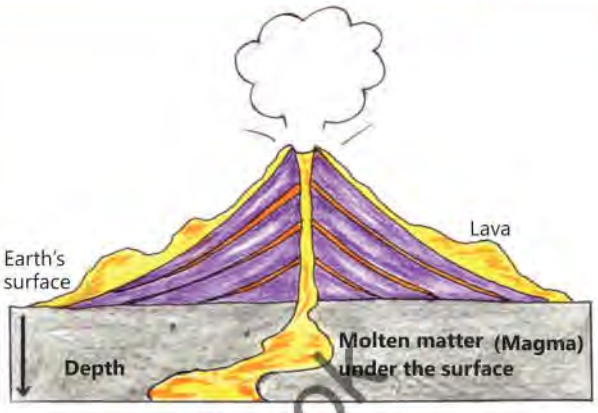
**Do You Know?**

Pakistan's deadly earthquakes owe their birth to the juncture of three colliding tectonic plates: Indian, Eurasian and Arabian. The Indian and Eurasian plates grind with each other along the Chaman Fault, triggering destructive earthquakes. Earthquakes along the Chaman Fault are more frequent in the north than in the south.



Volcanic Mountains

## MOUNTAINS IN PAKISTAN

Pakistan is surrounded by mountain ranges from North-Eastern, North-Western and Western sides. The most famous mountains of Pakistan include the mountains of Himalayas, Karakoram and Hindukush. These are folded mountains. The mountain ranges of Pakistan are divided into two segments.

i. Northern Mountains
ii. North- Western and Western Mountains

These two mountain ranges meet together at "Pamir Knot" in the north-east of Pakistan. Lets have a look on these mountain ranges.

### 1. Northern Mountains

There are two ranges in the northern mountains.

i. Himalayas
ii. Karakoram

**Do You Know?**

Islamabad is the capital of Pakistan that is located in the piedmont of Siwaliks.

#### i. Himalayas

The Himalayas are divided into three segments which are situated parallel to each other from south-east to north-west.

**Siwalik Hills**

Siwalik hills are foothills. The average height of these hills is about 800 metres. Islamabad, Attock, Rawalpindi etc are located in these hills.

**Lesser Himalayas**

In the north of Siwalik hills, are the mountains of Azad Kashmir and Pir Panjal. Average height of these mountains is about 4000 metres. These are called Lesser Himalayas. Murree, Kashmir, Guliyat and lower Hazara are situated in this range.

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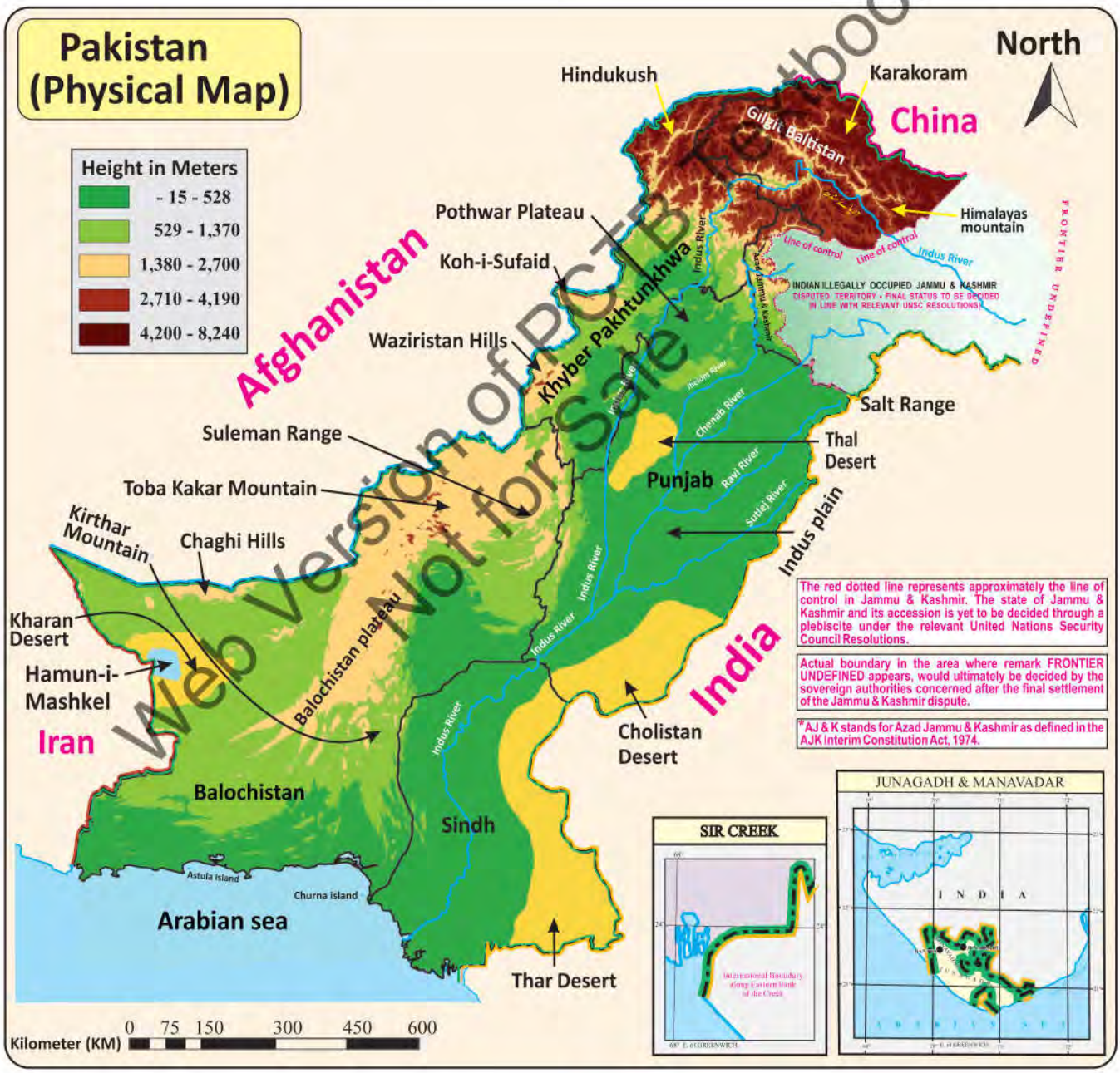
**Greater Himalayas**

Greater Himalayas are situated in the north of Lesser Himalayas. Gilgit, Swat, Kohistan are situated in this region. Average height of these mountains is about 6000 metres. The highest peak of this range is Nanga Parbat which is 8126 metres high.

### ii. Karakoram

In the north of Greater Himalayas, there is another range of snow peaked mountains, situated in Gilgit up to Skardu. This is called Karakoram range. The highest peak of this range is K-2

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which is 8611 metres high. K-2 is also called Godwin Austin. It is the second highest peak of the world. Huge glaciers are found in this range in which Siachin, Hispar, Baltoro, Biafo and Batura are important.

## 2. North-Western and Western Mountains

There are three mountain ranges in the west of Pamir Knot. Their height decreases towards south. These mountain ranges are:

### i. Hindukush Mountains

Hindukush mountains are situated in the north-west of Pakistan along the border of Afghanistan. This mountain range stretches from Chitral, Swat and Malakand up to river Kabul in the south. The highest peak of this range is Tirich Mir which is 7690 metres high.

### ii. Sufaid Koh and Waziristan Hills

In the south of Hindukush Mountains, from river Kabul to river Kurram, along the border of Afghanistan the mountain range called Sufaid Koh. These mountains are situated in Mohmund and Khyber agency. The valleys of Peshawar, Kohat and Bannu are also situated in these mountains. The highest peak of this range is Sikaram which is 4761metres high.

Waziristan Hills

In the south of Sufaid Koh from river Kurram to river Gomal are situated the less high, Waziristan hills.

### iii. Suleman and Kirthar Mountains

In the south of river Gomal up to river Bolan is situated the mountain range, known as Suleman mountains. These mountains are situated along the river Indus between Punjab and Balochistan. The highest peak in this range is Takht-e-Suleman which is 3487 metres high.

In the further south of river Bolan between Balochistan and Sindh is the mountain range known as Kirthar mountains.

**Activity Corner!**

Use available source such as maps, google maps or GIS to identify mountains, plateaus and valleys of the world.

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# MOUNTAIN VALLEYS

Large number of valleys are located in these mountains ranges. Some famous valleys in Hindukush range are Swat, Chitral and Dir. The Gilgit, Shigar, Skardu and Hunza are famous valleys of Karakoram whereas Murree, Galiyat, Kaghan and Abbottabad are significant valleys in Himalayas.

Kaghan Valley

## Types of Valleys

Northern mountains have diversified climate and topography. Maximum snowfall in Pakistan is observed on the peaks of these mountains that become glaciers with the passage of time. Melting of these glaciers in summer provides fresh water to rivers. Glacial work and rivers cause emergence of different valleys that are described as below:

**1. U-Shape Valley**

Glacier on the mountains continues its creeping movement along the slopes. Due to erosional work of glaciers U-Shaped Valley is formed.

**2. V-Shape Valley**

Glaciers melt and form streams and rivers. Fast flow of water erodes the rocks and starts to form narrow valley that is known as V-Shape valley.

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V-Shape Valley

U-Shape Valley

**Skill**

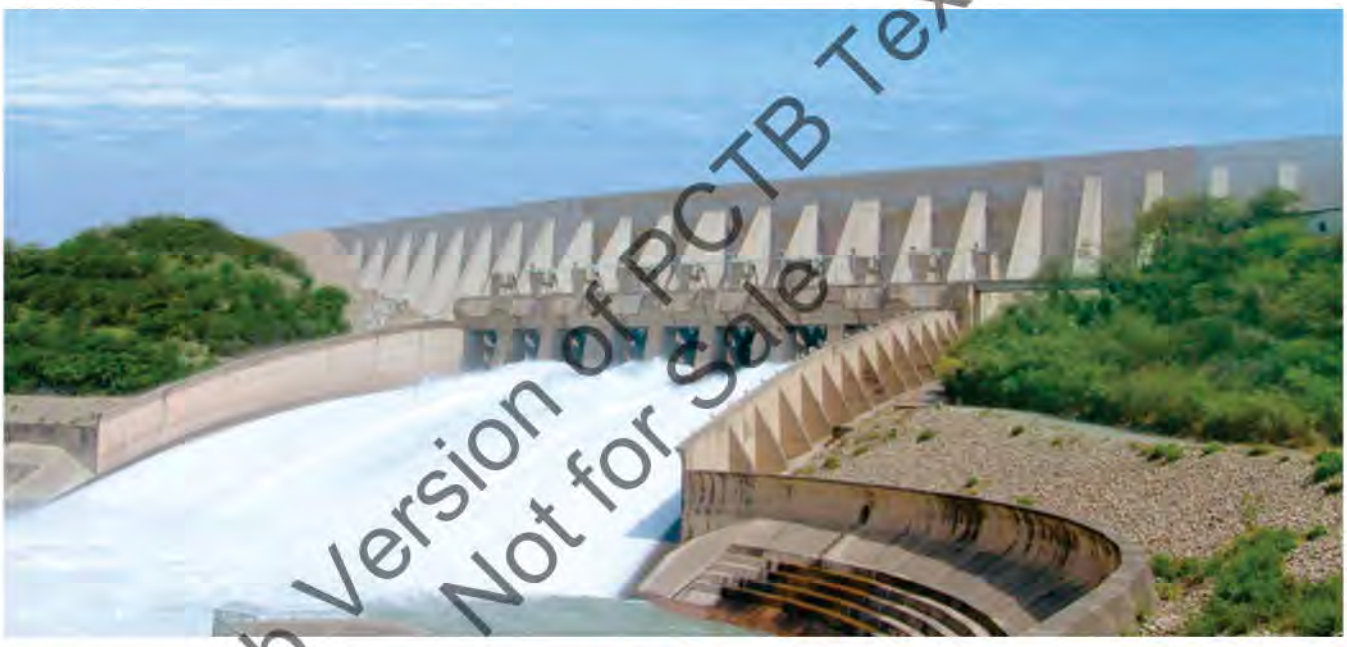
Draw a images of V-shape and U-shape valley in your notebook.

## IMPORTANCE OF NORTHERN MOUNTAINS

Northern mountains of Pakistan (Karakoram, Himalayas and Hindukush) have immense influence on the people and economy.

**Tourism:** Pleasant climate in summers, snowfall in winters, beautiful valleys and huge mountain peaks in northern areas are great attraction for tourists. Tourism in the area boosts the economy and provide employment to the local people.

**Power Potential (Hydro Electricity):** Fast flowing rivers and steep slopes in northern mountainous areas are best suitable conditions for hydro electricity production. All major dams of Pakistan are constructed in these mountains or their foothills. Moreover, many dams are under construction.



Mangla Dam

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**Natural Barrier:** The northern mountains of Pakistan form natural barrier from the movement from Central Asia to the plains of Pakistan because most of the area is hilly and proper infrastructure is not there.

**Fresh Water:** These mountains remain snow covered all the year and are the source of perennial water supply to the rivers of the Indo-Gangetic plains. Many mountain glaciers are located in these mountains that are actually huge reserves of fresh water.

**Climate:** These mountains also protect the plains of the sub-continent from the cold winds of Central Asia in winter. The southern slopes of these mountains are covered by evergreen forests because these mountains cause heavy rainfall on the southern slopes.

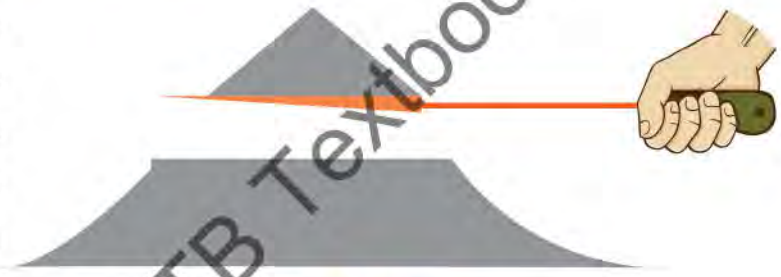
**Do You Know?**

**Why mountains are important for Pakistan?**

The mountain areas are rich in natural resources such as water, forests, pasture, and minerals, and can play a vital role in the country's development. The northern mountains are the main sources of surface water in the country and provide the basis for irrigation and hydropower.

## PLATEAUS

An elevated landmass with almost flat top and vertical slope minimum at one side is known as plateau. Its surface is cut by various narrow and wide valleys. Colorado Plateau (U.S.A.) and Potwar Plateau (Pakistan) are best examples.



Plateau

**Activity Corner!**

Draw image of plateau and mountain in your notebook. Write two differences between mountain and plateau.

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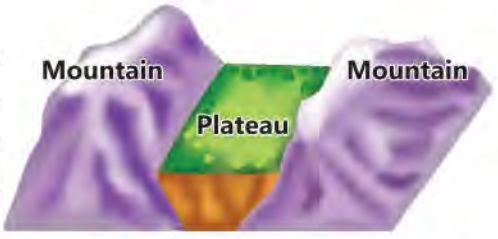
## TYPES OF PLATEAUS

Plateaus may be classified into the following types according to their location.

### 1. Intermontane Plateau

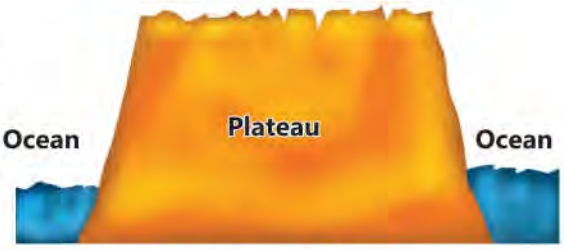
This type of plateau is formed by internal movements of the Earth along with mountains. For example, Tibet Plateau is located in between the mountains of Himalayas. Bolivian Plateau is another example located in between Andes Mountains (South America).




Intermontane Plateau

### 2. Continental Plateau

These are the plateaus uplifted from land or ocean due to internal movements of the Earth. There are no mountains in their surroundings. Antarctica, Greenland, Arabian Plateau and Plateau of Spain are its examples.




Continental Plateau

## 3. Piedmont Plateau

These plateaus are located at the foothills. and are surrounded by mountains from one side with ocean or plain on the other side. Patagonia Plateau (South America) in piedmonts of Andes and Potwar Plateau (Pakistan) in piedmonts of Himalayas are some other examples of piedmont plateau.

Piedmont Plateau

Potwar Plateau is a piedmont plateau situated in south of Siwalik hills. To its east is river Jhelum, towards west river Indus and to its south is the Salt range. Agriculture is dependent on natural rainfall mainly. Other than this, several oil and gas exploration sites lie in the Potwar Plateau indicating that along with fertile soil, this area is rich in natural resources.

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## Physical Regions and lifestyle of the people

Land features of our country and human ways of living are described as under. In our country, the Northern and North Western areas are mountainous. There is a large difference in temperature between plain areas and mountainous areas. Some areas remain covered with snow the whole year. The profession of people of these areas are handicrafts and farming. Tourism and hoteling industry is common in these areas. The beautiful Valleys of Northern and North Western areas attract the people to visit these places.

Naran Valley

Potwar Plateau

Plain areas of Pakistan have extreme climate, i.e., winters are cold and summers are warm. This kind of climate is favourable for agriculture and for the production of many other crops because plain areas are made up with the soil brought by the rivers. The profession of the people living in

plain areas directly or indirectly depends upon agriculture. The land in Pothwar plateaus is both rocky and soft. Along with small hills the water erosion has broken the land and caused depressions. Therefore, its land is not good for cultivation. The second largest salt mine of the world is located in this mountain range. Besides salt, coal and gypsum are important minerals found in this area.

## Key Points

- A landmass on the Earth's surface with rocky, uneven, sloppy and elevated surface is known as mountain.
- Andes Mountains (South America) are the longest folded mountains in the world.
- Pakistan is surrounded by mighty mountain ranges from northern and western side.
- Murree, Galiyat, Kaghan and Abbottabad are significant valleys in Himalayas.
- Glacier on the mountains continues its creeping movement along the slopes.

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## Exercise

**1 Circle the correct option:**

i. Rockies are located in:

a. Asia b. Europe c. South America d. North America

ii. The highest mountain range in the world is:

a. Himalayas b. Alps c. Andes d. Rockies

iii. The highest mountain peak in the world is:

a. Nanga Parbat b. Mount Blanc c. Mount Everest d. K-2

iv. K-2 is also known as:

a. Godwin Austen b. Mount Blanc c. Kohsar d. Nanga Parbat

v. Rift Valley is formed in which type of mountains:

a. Residual b. Folded c. Volcanic d. Block

vi. River forms which type of valley:

a. U-shape b. W-shape c. V-shape d. Y-shape

## 2 Answer the following short questions:

i. Define mountain.

ii. What are different types of mountains in the world?

iii. Enlist the names of famous mountain ranges in Pakistan.

iv. What is rift valley? Write its example.

v. Define continental plateau.

vi. What is meant by V-shape Valley?

vii. What is the difference between fold and fault?

## 3 Answer the following questions in detail:

i. There are different types of mountains in the world. Discuss each of them.

ii. What are different types of plateaus? Elaborate.

iii. What are the impacts of mountains on human life?

iv. Write a descriptive note on the mountains of Pakistan.

### Critical Thinking Questions:

- How physical regions of Pakistan effects the life of the people?
- Explore the impacts of earthquake on ecosystem.
- How Himalayas are important for Pakistan?
- Explore importance of valleys for Pakistan.

### Learning Activities:

**The Teacher will:**

i. Use presentations, diagrams, and videos to explain the earthquake prone areas of Pakistan.

ii. Where do you live? Make a list of landforms around you. How did that landforms come into existence? Discuss with your teacher.

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Unit 3

# CLIMATIC REGIONS OF THE WORLD

**Student's learning outcomes:**

**After completing this lesson, the students will be able to:**

- Identify factors that affect the climate of a region.
- Name and describe climatic zones of the world.
- Identify plants that grow in different climatic regions.
- Describe climatic zones of Pakistan.

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## Weather and Climate

Short term atmospheric conditions of temperature, rainfall, air pressure and amount of humidity at a particular place and time is known as weather. While long term conditions of all seasons and weathers is called climate. Climate is actually average of weather for a longer period of time. This duration may be 25-35 years or even more and weather is a short time change in atmospheric conditions.

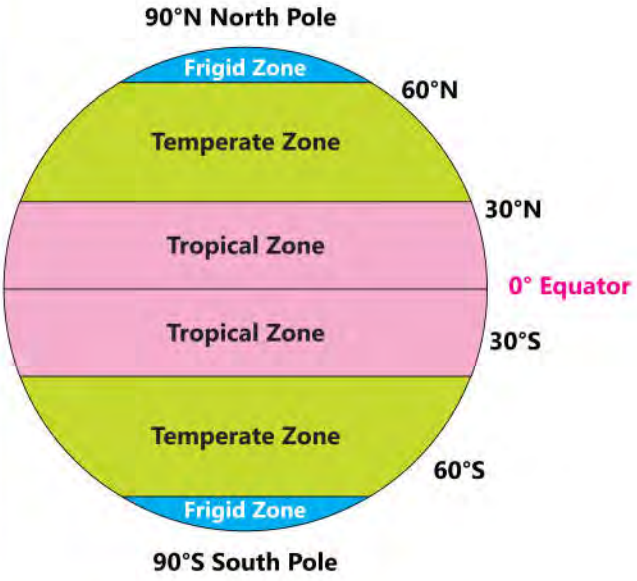
**Do You Know?**

The world is divided in three temperature zones.

**Tropical Zone:** It lies between Tropic of Cancer and Tropic of Capricorn (30°N – 30°S).

**Temperate Zone:** It is located between Tropic of Cancer and Arctic Circle in north and Tropic of Capricorn and Antarctic Circle in south (30°N – 60°N and 30°S – 60°S).

**Frigid Zone:** Location of this zone is in between North Pole and Arctic Circle in north and South Pole and Antarctic Circle in south (60°N – 90°N and 60°S – 90°S).

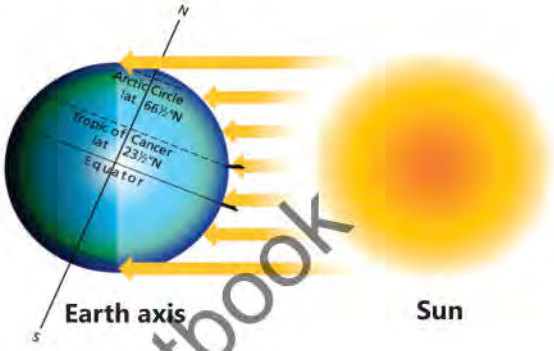


# FACTORS AFFECTING CLIMATE

Climate all over the world is not the same. Variation in climate is due to the following factors:

## 1. Latitude

Sunrays vertically fall on equatorial areas. So the distance from the equator directly influences the climate of the area. The general climate near the equator is hot. Sunrays are inclined in frigid zone. Therefore, where the poles, the climate is cooler/cold.




## 2. Distribution of Land and Water

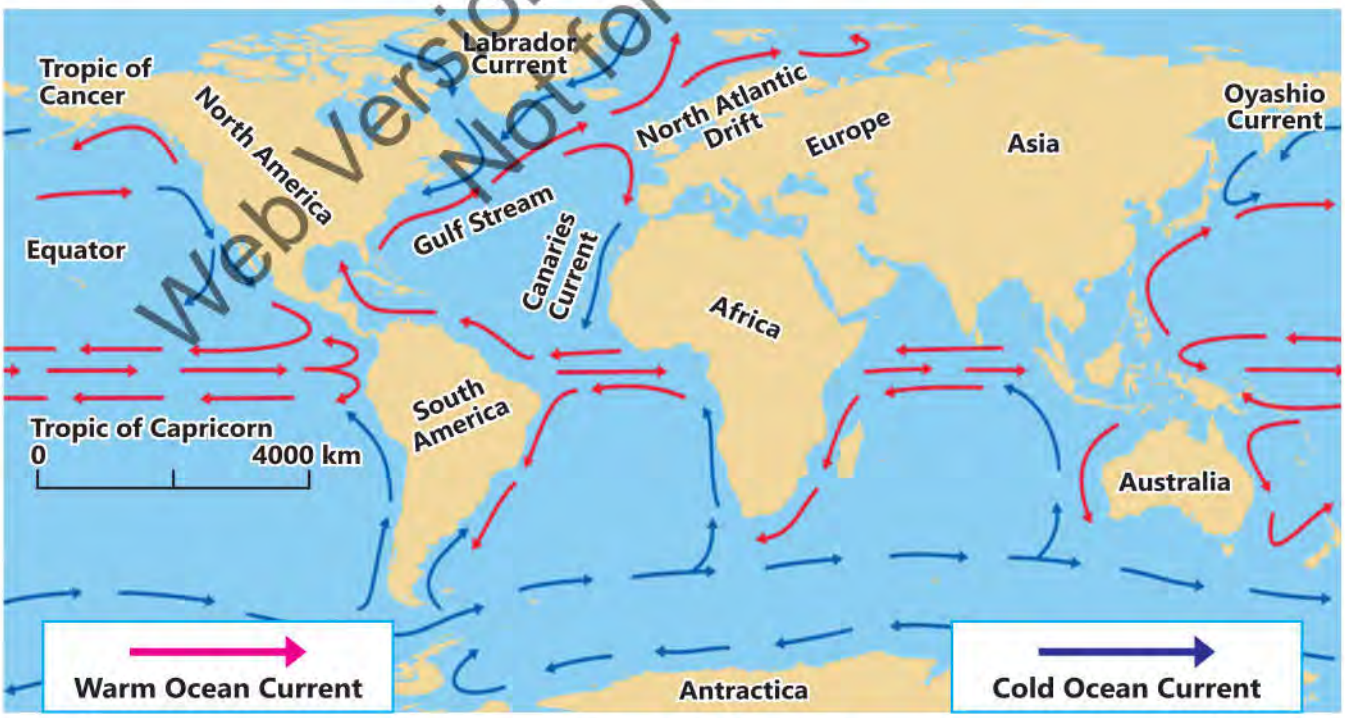
Earth's surface is divided into water and land. Water covers 71% while land covers 29% area of the world. Continents get warmer earlier during daytime while get cooler after sunset. Unlikely, water takes more time to get warmer or cooler.

## 3. Ocean Currents

Ocean currents flow from cooler to hotter areas and hotter to cooler areas. Whenever warm

**Do You Know?**

Solar energy that reaches the earth and/or its atmosphere is called insolation.




Ocean Currents in the World

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current reaches colder area, it increases the temperature of that area, for example, warm current of North Atlantic Ocean. Similarly, colder currents decrease the temperature of hot areas. For example, Canary Current.

**Do You Know?**

Karachi and Gwadar are coastal areas of Pakistan that remain moderate throughout the year whereas Lahore is almost 1000km away from sea so remains hot in summers and cold in winters.

### 4. Winds

Winds also blow from hotter to colder and colder to hotter areas that increase or decrease the temperature as is the case with land and sea breezes and mountain and valley breezes.

### 5. Clouds

More cloud formation in any area decreases the temperature because clouds reflect sunrays and allow very little sunrays to reach the Earth's surface.

### 6. Altitude

Earth gets heat from the sun and gets warmer by sunrays. Atmosphere above the surface starts to get hot in result of energy absorbed by the earth surface. Temperature keeps on decreasing with increase in elevation. Average 6.5° C temperature is decreased at every 1000 m (1km) elevation.

## CLIMATIC REGION OF THE WORLD

The world is divided into several regions according to climate that may be explained as follow:

"A climatic region is roughly demarcated by lines of latitude into which the earth can be divided on the basis of climate".

**Do You Know?**

A region is a geographical area which is homogeneous in terms of geographical characteristics such as climate, soils, vegetation, socio-economic activities, etc.

The world is classified into four main climatic regions that are briefly discussed below:

### Equatorial Climatic Region

It is located in between 5° north and 5°south of equator where weather remains hot and humid for the whole year. Evergreen forests are found here. Indonesia, Malaysia, Southern Sri Lanka, Congo Valley, Coast of Guinea and East African Countries and Amazon Valley are part of this region.

**Climate**

Climate of this region is hot and humid. Sunrays fall vertically here for the whole year. Intensity of sunrays causes hotness, so summers remain here for the whole year. Temperature of this region is high and remains constant. It remains around 27° average all the times. Daily range of

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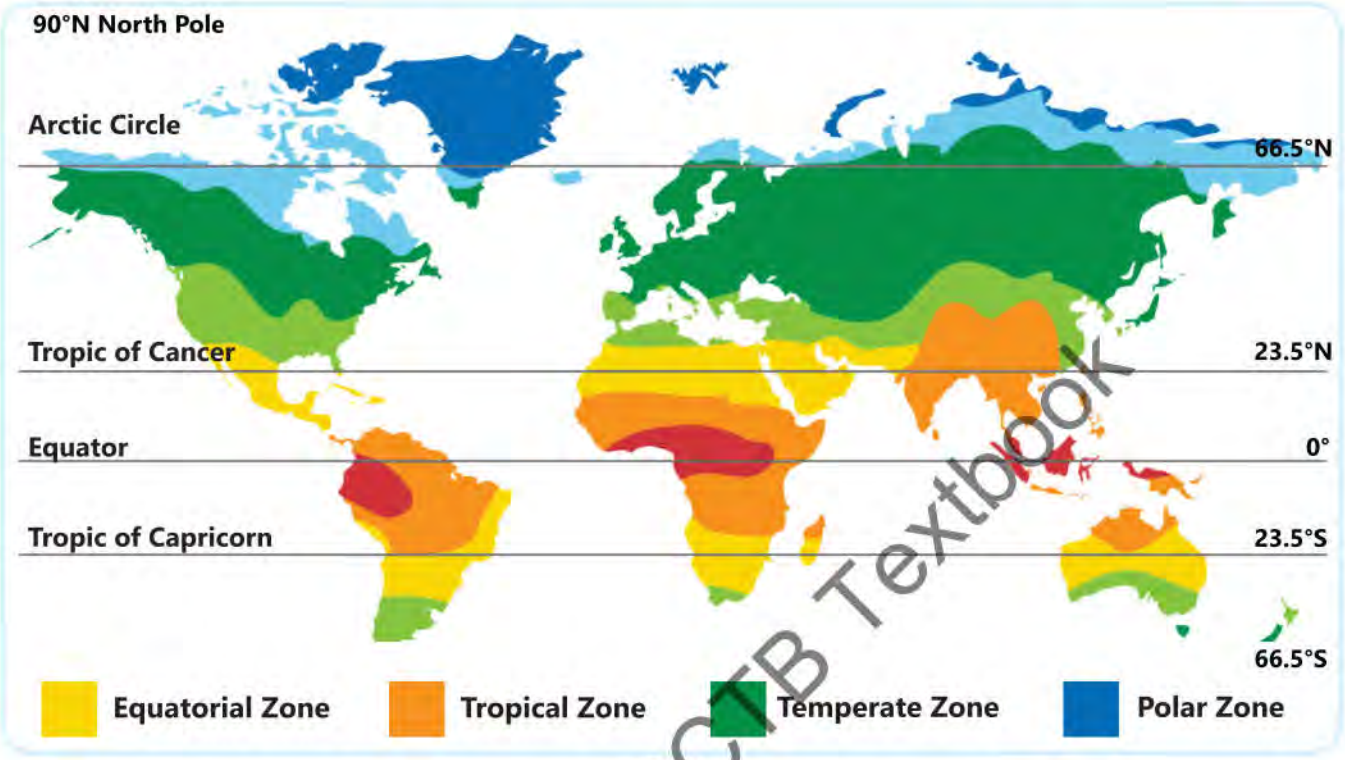


temperature is high because nights are colder. Huge amount of humidity remains in the atmosphere that affects human health. Rainfall occurs for the whole year.

**Vegetation**

Dense forests are found here because of hot humid climate. Trees are so high that sunlight is unable to reach the earth. Trees are evergreen that include Ebony, Mahogany, Sagwan (teak), Rubber and Salvadora persica.

**Do You Know?**

The densest rainforests in the world are Amazon forest and Congo forest that lie in equatorial region.

**Human Activities**

Population is scarce in dense forests. Hot humid climate is harmful for health. Malaria is too common. Natives are black people that are settled along rivers and oceans in small settlements. Hence, people cover themselves by plant leaves. Wild people with small height lives in Congo. People are uncivilized. People have no interest in religion, education

Rubber-Tree in Amazon

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or literature. People living in Amazon are comparatively tall in height and not as much black. These people live in tribes and are known as Red Indians. People of this region are prosperous as agriculture and industry have progressed. Rice, sugarcane, rubber, spices, tea, qahwa, tobacco, banana and coconut etc. are the main crops of this region.

## Tropical Climatic Region

This region is located at both sides of equator till $30^0$ N and $30^0$ S. It is hot region where sunrays fall vertically for whole year. Great Sahara Desert, Kalahari Desert, Colorado and Arizona (U.S.A.). Northern Chile, Southern Peru and southwestern Australia are famous areas in this region.

Date palm in an oasis

### Climate

Climate of this region is continental as winter and summers, both are extreme. Winds blowing during daytime are named as Simoom in Arabian and Sahara Deserts and Loo in the Indo-Pak subcontinent. Snowfall occurs on mountain tops in winters. Fog and mist are observed in coastal areas. Annual rainfall in this region is less than 10 inches.

Only grass is grown as natural vegetation due to less amount of rainfall. Dense vegetation is limited to the areas of higher rate of rainfall. Cactus, cereus and acacia are important trees.

**Do You Know?**

Tropical climate region is the driest region in the world.

### Human Activities

Agriculture is not possible in desert areas due to water scarcity. Agriculture is possible only in the areas where irrigation is done by rivers and tube wells. Such irrigated region is important for agriculture. Profession of people in this region is mainly animal herding. People graze their animals where grass is available. Animals are reared which

An oil field in Saudi Arabia

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include sheep, goats, camels and horses. This region is rich in mineral resources so people are engaged with the profession of mining as well. All gulf states are enriched with oil reserved so industry of desert areas has notable progress. High quality cotton, wheat, rice and sugarcane are cultivated.

Minerals of this region are famous all over the world. Oil refineries and textile industries are also there in this region.

**Activity Corner!**

Why the tropical climate region is rich in minerals?

## Temperate Climatic Region

This region is located in both of the hemispheres i.e. 30° N to 60° N in northern hemisphere and 30° south to 60° south in southern hemisphere. It is known as North Temperate Region in northern hemisphere and South Temperate Region in southern hemisphere. Brazil, West Indies, Northeastern Australia, Pakistan, India, Myanmar (Burma), Vietnam, Southern China and Philippines etc. are important areas in this region.

**Climate**

This region has hot humid and moderate type of climate. Summers are hot. Temperature increases towards interiors of the continents, coastal areas remain moderate due to sea.
Rainfall in this region depends on direction of mountains. Himalayas are important mountains in this region that interact with monsoon winds which cause rainfall.

Evergreen forests grow in some parts of this regions, where annual amount of rainfall is more than 80 inches per annum. Deciduous forests grow in the areas where annual rainfall is in between 40-50 inches per annum.

**Human Activities**

Densely populated areas are found in this region due to suitable climate. People need grains to fulfil their needs so this region is important for agriculture. Soil fertility and rainfall have made this region feasible for agriculture. Rice, cotton, sugarcane and jute are cultivated in the areas of more rainfall whereas wheat, barley and edible product are cultivated in summers.

An Agricultural field in Pakistan

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Banana, mangoes and mulberry are important fruits of this region.

## Polar Climatic Region

This region is located at both sides of equator as well from 60° N to 90° N in northern hemisphere and from 60° S to 90° S in southern hemisphere. It consists of coastal areas of Arctic (Northern) Ocean. Siberia, Northern Russia, Northern Norway, Sweden, Finland, Greenland and Northern Canada are famous areas in this region.

An igloo in Polar Region

**Activity Corner!**

Use available source such as maps, google maps or GIS to locate climatic zones of the world and Pakistan.

### Climate

It has extreme climate as it is located near North and South Poles. Winter is extremely cold and longer. Blizzards blow in nights that cover the earth surface with snow. Rainfall is scarce with annual amount ranging 10-12 inches per annum. People in this region live in some certain houses named igloo. Lichen, mosses, algae and flowered shrubs may grow in this region. The areas above seventy fifth latitude are experienced extreme cold weather. This region has no summer season. The temperature remains below zero degree throughout the year.

### Human Activities

This region is less densely populated. Hunting is the main economic activity. People are nomads and their lives depend on reindeer as they rear this animal.

Fishing and animal herding are the main professions of people. Reindeer provides milk for children, meat for adults and is used for transportation. People living in Northern Canada are known as Eskimos.

Herd of Reindeer

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## IMPORTANCE OF CLIMATE IN HUMAN LIFE

Climate has significant impacts on human life as human activities are influenced by it. All economic, social, political and commercial activities of people living in any area are based on climate. Climate not only influences human activities but also modifies structure of different surface features. The impacts of climate are discussed below:

**Climate and Human Activities**

Human activities, lifestyles, customs and traditions vary from place to place all over the world along with the variation in climate. Rainfall, winds and other weather elements especially temperature affect the man directly. Areas with continental climate are less densely populated. Roofs of houses are sloppy in the areas of higher rate of snowfall. Houses are built in hotter areas in such a way that roofs are highly elevated and houses are wider and airy to avoid heat intensity.

**Climate and Animals**

Animals are also affected by climate. For example, camel is an animal of desert as it may survive without water for several days while eating small shrubs of deserts. Sheep are found in dry mountainous areas.

Climate and Animals

**Climate and Agriculture**

Temperature, humidity, rainfall and evaporation, etc. affect the agriculture at large scale. Climate directly affects crops distribution and per acre yields in any of the regions. Hence, certain crops are cultivated in certain climatic regions. For example, wheat is important crop in temperate region while rice and rubber are extensively cultivated in equatorial as well as monsoon region.

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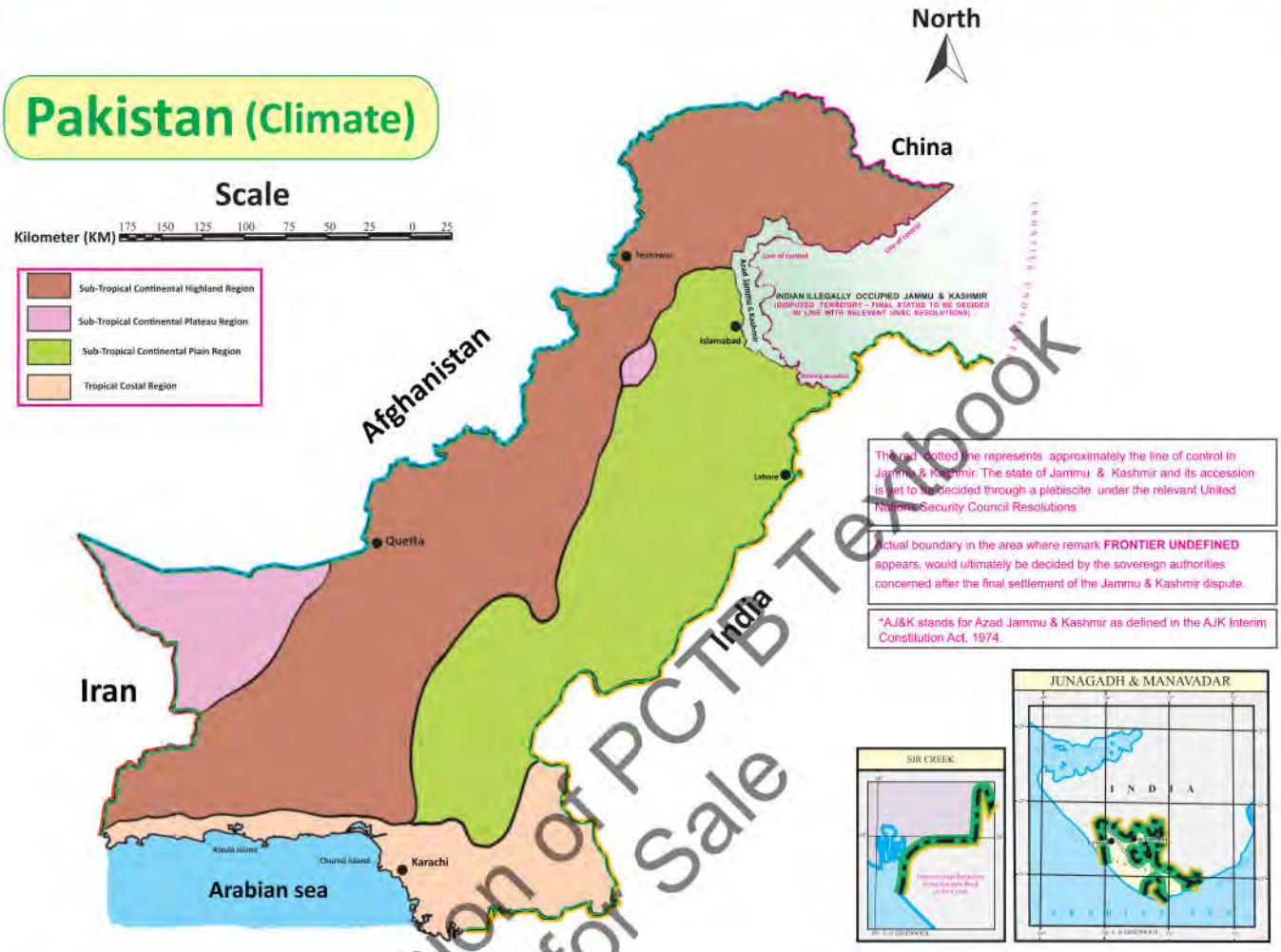
## CLIMATIC REGIONS OF PAKISTAN

The long term study of weather conditions of any country or area is called climate. The weather conditions include temperature, air pressure, rain and humidity etc. Pakistan is divided into following climatic regions:-

1. Sub-Tropical Continental highland
2. Sub-Tropical Continental plateau
3. Sub-Tropical Continental lowlands
4. Tropical Coastland


Pakistan (Climate)
North
Scale
Kilometer (KM) 175 150 125 100 75 50 25 0 25
Sub-Tropical Continental Highland Region
Sub-Tropical Continental Plateau Region
Sub-Tropical Continental Plain Region
Tropical Costal Region
China
Afghanistan
Iran
India
Arabian sea
Peshawar
Islamabad
Lahore
Quetta
Karachi
Line of Control
INDIAN ILLEGALLY OCCUPIED JAMMU & KASHMIR
(DISPUTED TERRITORY – FINAL STATUS TO BE DECIDED IN LINE WITH RELEVANT UNSC RESOLUTIONS)
The red dotted line represents approximately the line of control in Jammu & Kashmir. The state of Jammu & Kashmir and its accession is yet to be decided through a plebiscite under the relevant United Nations Security Council Resolutions.
Actual boundary in the area where remark FRONTIER UNDEFINED appears, would ultimately be decided by the sovereign authorities concerned after the final settlement of the Jammu & Kashmir dispute.
*AJ&K stands for Azad Jammu & Kashmir as defined in the AJK Interim Constitution Act, 1974.
SIR CREEK
JUNAGADH & MANAVADAR
I N D I A

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## 1. Sub-Tropical Continental Highland

This climatic region includes Pakistan's northern mountain ranges (outer and central Himalayas), north western mountain ranges (Chitral, Swat and Dir etc.), Western mountain range (Waziristan, Zobe and Loralai) and the mountain ranges of Balochistan (Quetta, Sarawan, Central Makran and Jaliwan). Here the winter is extremely cold and normally there is snow fall. Summer season is quite cool while in spring season there is rainfall.

In some areas of this region such as outer Himalayas, Muree and Hazara districts, rainfall continues almost throughout the year. But mostly the rain falls at the end of the Summer season.

## 2. Sub-Tropical Continental Plateau

This climatic region includes most area of the Balochistan. Hot and dusty winds continuously blow there from May to the mid September. Sibbi and Jacobabad are located in this very region. There is some rainfall during the months of January and February. Extreme hot weather, dry and dusty winds are important characteristics of this region.

### 3. Sub-Tropical Continental Lowland

This climatic region includes the upper Indus plain (Punjab province) and lower Indus plain (Sindh province). Summer is very hot in this region and torwards the end of summer northern Punjab receives more rainfall due to monsoon winds, while plain areas receive less rainfall. Winter rainfall pattern is also the same. Thal and the Southeast desert are the driest areas that receive very little rainfall. Peshawar plain experiences thunder storms rain and dust storms. During summer, dust storms are very common in Peshawar.

### 4. Tropical Coastland

This climatic region includes the coastal areas of Sindh and Balochistan provinces. The difference between maximum and minimum range of temperature is small. There is inflow of sea breeze throughout the Summer, the humidity is high and annual average temperature is 32°C. May and June are the hottest months. The plain of Lasbela receives rainfall both in Summer and Winter seasons.

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## PRESSURE AND WINDS

Pressure is high due to monsoon winds and receives most of the rainfall due to summer monsoons. During summer central Asia and plains of India becomes hot, and low pressure is developed. The winds are directed from the near sea where high pressure is present. The Balochistan Plateau is outside the reach of the summer monsoon and gets little rain in summer. The northern part of Balochistan receives more rain in winter. This is due to the western disturbance coming from the Mediterranean Sea.

### Rainfall

Over a large part of the country, most of the rainfall is associated with the monsoon winds. The other source is the passage of the western disturbances.

Winter Rainfall

Summer Rainfall

In coastal areas tropical storm from the Arabian Sea and the thunder storm associated with thermal instability produce some rainfall. More than three quarter of the rainfall in Pakistan is obtained from the summer monsoon.

The northern mountains, the north-western region and also the western part of the plain get sufficient rainfall from the western disturbance in winter. In Pakistan humidity is generally low and the air is dry for the greater part of the year. Only in a coastal area near Karachi there is plenty of moisture in the air to make it humid due to the proximity of the area.

**Skill**

Why do the lower slopes of Himalayas receive maximum rainfall in Pakistan?

## Key Points

- Atmospheric conditions of temperature, rainfall, air pressure and amount of humidity at a particular place in a particular time is known as weather.
- Climate is actually average of weathers for a longer period of time.
- Equatorial areas are hotter, temperate areas are moderate and polar areas are colder.
- A climatic region is roughly demarcated by lines of latitudes into which the earth can be divided on the basis of climate,
- Cocoa and palm are abundant but rubber tree is the most important in equatorial climatic region.
- Rice, sugarcane, rubber, spices, tea, qahwa, tobacco, banana and coconut etc. are cultivated in rainforests.
- People in polar climatic region live in some certain houses named igloo.

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## Exercise

**1 Circle the correct option:**

i. Sahara Desert is located in climatic region of:

a. Equatorial b. Tropical c. Temperate d. Polar

ii. Profession of the people living in tropical area is:

a. Agriculture b. Wood Cutting c. Animal Herding d. Jobs

iii. Monsoon winds blow in which region:

a. Equatorial b. Tropical c. Temperate d. Polar

iv. Famous animal of polar climatic region is:

a. Camel b. Reindeer c. Lion d. Cow

v. People living in Northern Canada are known as:

a. Pathan b. Red Indians c. Eskimos d. American

vi. Land and sea breezes blow in:

a. Deserts b. Mountains c. Coastal Areas d. Plateaus

## 2 Answer the following short questions:

i. Define weather and climate.

ii. Define climatic region.

iii. Write the names of different climatic regions of the world.

iv. Define equatorial climatic region.

v. What do you know about vegetation in polar climatic region?

## 3 Answer the following questions in detail:

i. Explain about weather and climate. Describe the factors affecting the climate of any place.

ii. Classify Pakistan into different climatic regions and give brief description of each.

iii. Discuss tropical climatic region in detail.

iv. Write the importance of climate in human life.

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## Critical Thinking Questions:

- How climate effects our life?
- Explore the impacts of vegetation on our climate.
- Why climatic zones of the world are different?
- How monsoon effects the climate of Pakistan?

## Learning Activities:

**The Teacher will:**

i. When did you observe the rainfall last time? Think! What might be the reason behind that?
ii. Suggest ways to improve the quality of global weather.
iii. Investigate factors that effect climate of the region.

## Project for Students:

- Make a model of climatic regions of Pakistan.

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Unit 4

# FORESTS OF THE WORLD

**Student's learning outcomes:**

**After completing this lesson, the students will be able to:**

- Differentiate between natural vegetation and agriculture.
- Explain the link between climate and natural vegetation.
- Compare and contrast rainforests with other types of forests.
- Explore different shapes and functions of the three layers of the rainforests.
- Describe the importance of the Amazon rainforest.
- Evaluate how forests play an important role in the economy of the region.
- Identify the four major types of forests in Pakistan.
- Discover different types of trees in the northern areas of Pakistan.
- Explore why the forests of the various regions across Pakistan differ.
- Describe ways in which forests are helping the environment of a place.
- Suggest ways to minimize deforestation.

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Natural vegetation is a type of vegetation in which plants grow without the interference of humans. It does not need watering from humans as they obtain water from rainfall. It does not need to add any fertilisers, pesticides etc. to the soil since it is already fertile. The natural vegetation

Natural vegetation

Agriculture

consists of forests, grasslands, mosses, lichens, algae and shrubs, etc. Agriculture is defined as the growing and harvesting of crops in particular natural and human environment. Plants in agriculture do not grow automatically but are controlled by humans. **"Agriculture is an activity done by farmers to yield crops"**.

## Types of vegetation

Natural vegetation may be classified into three main types.

- **Forest**
- **Grassland**
- **Desert Vegetation**

Grassland

Forest

Desert vegetation

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**Do You Know?**

Some vegetations are grown by human beings as well which are known as cultivated vegetation.

## CLIMATE AND NATURAL VEGETATION

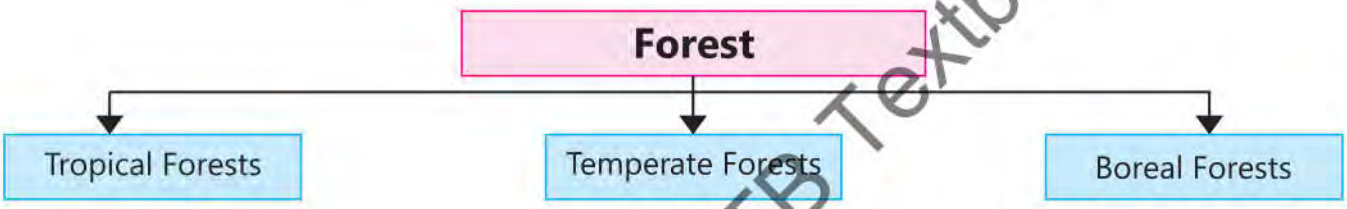
Natural vegetation in any area is greatly influenced by climate (precipitation and temperature). Three main types of vegetation exist actually due to unequal distribution of precipitation. Areas with more than 100 cm (1000 mm) rainfall generally support forests, places

with 25-100 cm (250-1000 mm) rainfall have grasslands whereas desert vegetation is found in the areas with less than 25 cm (250 mm) rainfall.

Temperature is another element which is responsible for classification of forests into various subtypes. Distribution of vegetation changes due to change in temperature. Hotter areas generally have more lush vegetation as compared to the colder areas as very few plants grow in areas with less than 40° C.

## TYPES OF FORESTS

There are three main types of forests that are as follows:




### i. Tropical Forests

Forests situated in equatorial and sub-equatorial areas between 30° N to 30° S are known as tropical forests. These areas are hot while winters are short and cool. Season remains same throughout the year so daily and annual range of temperature is ignorable. This condition is suitable for dense growth of vegetation. The most common type of tropical forests is evergreen rainforest.

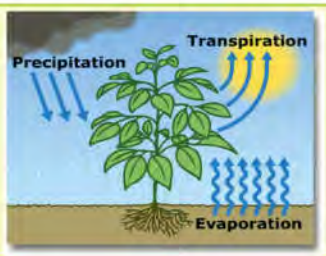
**Rainforests**

These forests are situated in equatorial belt which include some parts of Africa, Southeast Asia and South and Central America. Amazon Basin (South America) and Zaire Basin (Africa) are two largest regions all over the world having rainforests. Trees in rainforests are taller and highly dense.

Rainforests

**Do You Know?**

Evapotranspiration means evaporation of water into the atmosphere from the soil surface, It also includes transpiration, which is the water movement from the soil to the atmosphere via plants.

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## LAYERS OF RAINFORESTS

Rainforests have the following different layers.

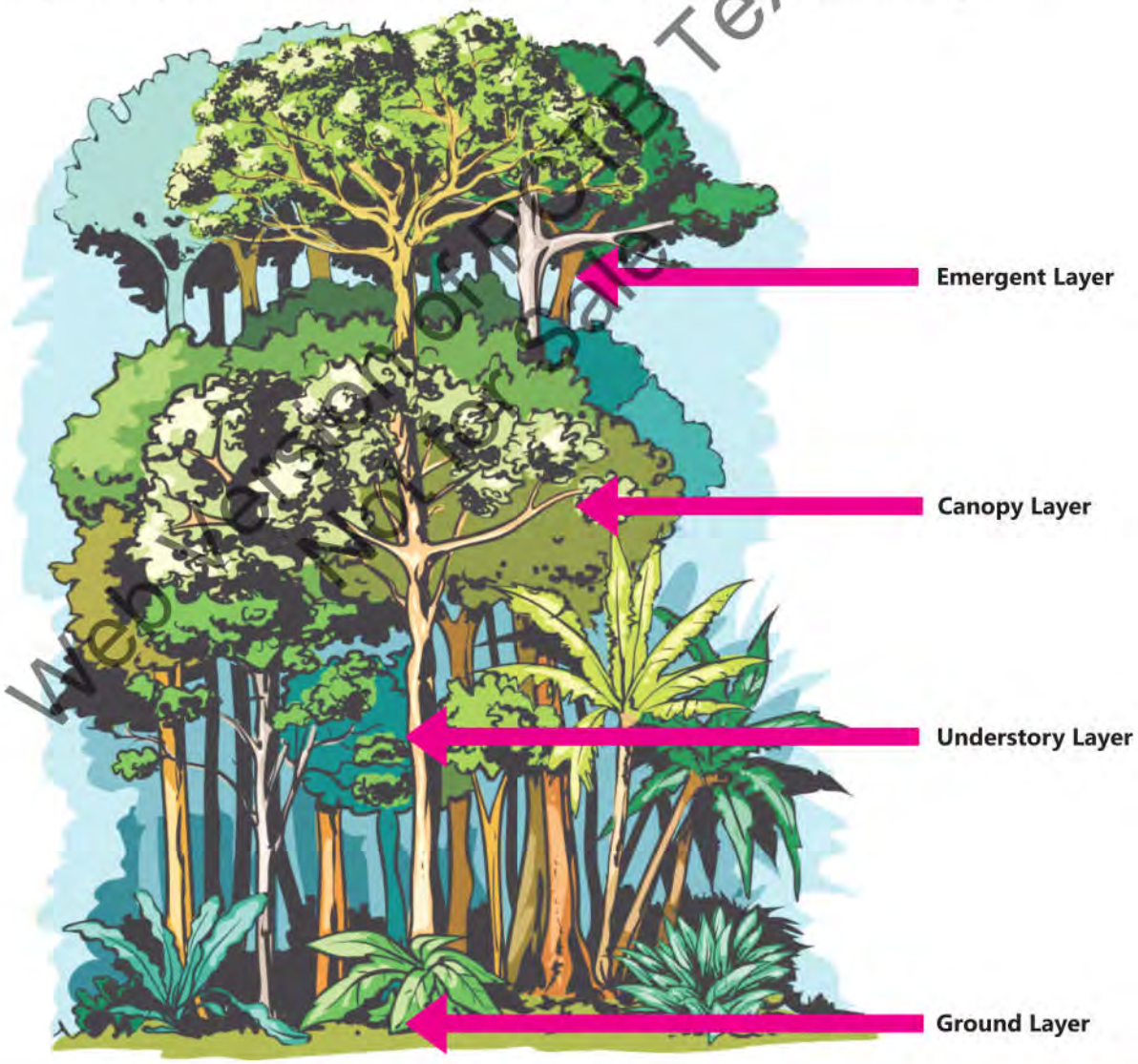
**Emergent Layer**

Upper most layer of the forest where the tallest trees rise above the surroundings are known as emergent trees which are found in limited number. Their average height is 40-55 meter. Species like bats, certain types of monkeys and butterfly live here.

**Canopy Layer**

Tall trees with average height of 30-40 metres are known as canopy trees. They are extremely close to each other so that their crowns are mixed up with each other to form a continuous canopy. This layer doesn't let the sunlight to penetrate.

Non-parasitic plants i.e. lianas and epiphytes etc. may also be found in this layer.




Layers of Rainforests

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**Understory Layer**

This layer lies between ground layer and canopy layer. Number of insects, birds, lizards, snakes and leopards live in this layer as short-heighted trees are found here.

**Ground Layer**

Smaller plants like algae, mosses, ferns and fungi etc. are found here as they do not require more sunlight to grow up. Canopy layer resists sunlight to reach the ground therefore, ground layer has sparse vegetation.

### Trees and their Characteristics

Most of the trees in rainforests are hardwoods. Seraya, ebony and ironwood are some examples of such trees.

Characteristics of these trees are as below:

- Trees in rainforests have broad leaves.
- Loss of moisture from soil through transpiration is minimum.
- Many plants have sweet smelling fruits and colourful flowers.

## ii. Temperate Forests

Temperate forests are situated in temperate areas with annual precipitation ranging from 750 mm to 1750 mm. Unlike tropical forests, these forests are not as much dense and contain three to four species of plants per hectare.

There are two main types of temperate forests.

- Deciduous Forests
- Coniferous Forests

**Deciduous Forests**

Location of these forests is between 25° to 40° latitudes in both hemispheres. Regions having deciduous forests include various parts of China, Korea, Europe, eastern U.S.A. and southeastern Australia.

Deciduous Forests

Coniferous Forests

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### Trees and their Characteristics

Famous trees in deciduous forests are hardwoods which include the species of Oak, Elm, Maple, Pine, Fir and Walnut. Characteristics of their trees may be described as below:

- Trees have broad leaves.
- Trees in deciduous forests shed their leaves in autumn.
- Shedding of leaves reduce transpiration.
- Deep roots hold and support the tree and allow them to suck the groundwater.

**Coniferous Forests**

Another type of forests in temperate region is coniferous forests which are mostly situated in northern hemisphere between the latitudes of 45° and 60°. Main areas having coniferous forests are northern parts of Asia, North America and Europe.

They have straight-trunked and cone-shaped trees with uniform height.

### Trees and their Characteristics

These forests have evergreen softwoods which include the trees of Redwood, Pine, Cedar, Spruce and Fir. Deer, Black bear and Spotted Owl are notable animal species found in coniferous forests. Prominent characteristics of these forests are:

- Trees are conical in shape.
- Their conical shape allows the snow to slide down.
- Leaves are narrow and small.
- Roots are shallow so they can take nutrients from top soil easily.

## iii. Boreal Forests

These are also known as taiga forests which are located in colder areas like Northern Canada, Siberia and Scandinavia. These forests observe short summers and long winters. Rainfall remain 40-100 cm annually. Trees are mostly evergreen.

**Do You Know?**

Denmark, Sweden, Norway, Finland and Iceland are known as Scandinavian countries. They contain almost 65% of total boreal forest in the world.

# IMPORTANCE OF AMAZON RAINFOREST

Amazon rainforests are the largest one not only in South America but in the world, which are almost 60% of total world's rainforests.

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### Precipitation

Transpiration of the forest is the main reason of precipitation. Influences of this transpiration and resulting rainfall extends over Central America and western parts of USA as well.

### Regional Benefits

Millions of people living in Amazon depend on services afforded by the forest. Rivers are the main source of transportation whereas timbering and related industries are important in the region. Fishing is another important economic activity.

### Carbon Storage

Amazon region has about 390 billion trees which lock up huge amount of carbon in their trunks, branches and leaves. Almost 86 billion tons carbon is stored by these forests as per estimates.

Amazon Biodiversity

### Biodiversity

No other ecosystem on the earth has as much diversified species of plants and animals as Amazon has. Estimates reveal that around 30% of the total world's species are found here.

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## ROLE OF FORESTS IN ECONOMY

Forests play significant role in the development of any country. Forests are an important natural resource on which economy of the region depends.

**Economic Activities:** Forests provide places for hunting, recreational activities and tourism. Adventurers from foreign countries visit Central Africa, Amazon and other forests which boosts the economy. Forests provide fruits to human beings and fodder to animals as well.

**Water Flow:** The rivers and streams receive the rainwater and flow along mountains slopes. The forests on these slopes restrict the speed of flow and help in maintaining a regular and constant flow of water to the plains.

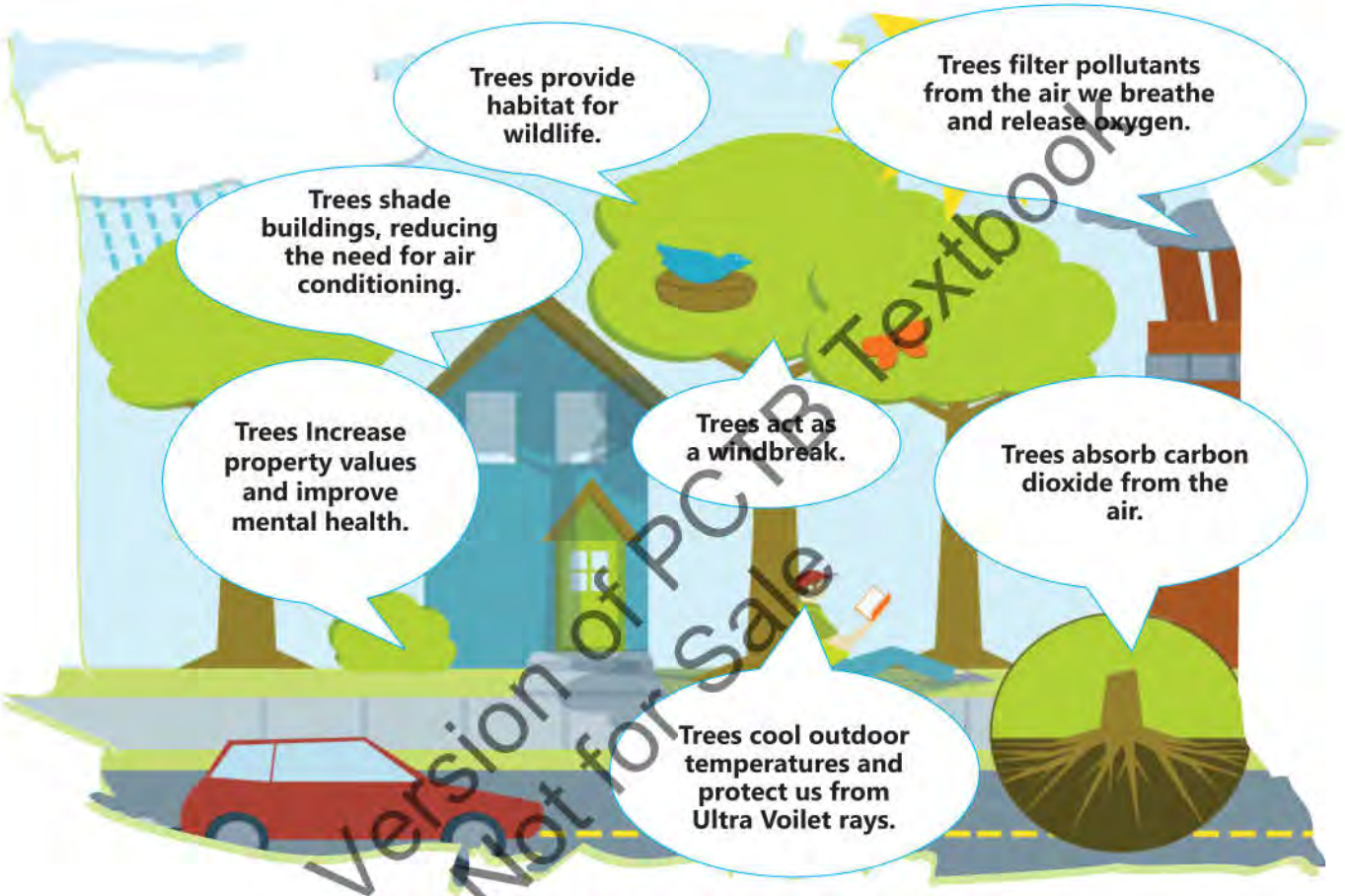
**Energy Resource:** Energy resources are limited in various parts of the world. Forests make up the deficiency of coal by fuelwood.

**Agriculture:** Forests trees help in maintaining the fertility of the soil which could otherwise be washed away by the running water on the slopes. The roots of trees keep the soil intact. They are also helpful against water logging and salinity.

**Storage of Water Reservoirs:** Forests prevent the soil erosion. The broken material may collect in the bases of water reservoirs. Therefore, storage capacity of dams retains.

**Medicines:** Valuable medicinal herbs are obtained from forests.

## FORESTS HELPING ENVIRONMENT


Trees provide habitat for wildlife.
Trees filter pollutants from the air we breathe and release oxygen.
Trees shade buildings, reducing the need for air conditioning.
Trees Increase property values and improve mental health.
Trees act as a windbreak.
Trees absorb carbon dioxide from the air.
Trees cool outdoor temperatures and protect us from Ultra Voilet rays.

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## TYPES OF FORESTS IN PAKISTAN

Following types of forests are found in Pakistan.

**1. Coniferous Forests**

The Northern and northwestern mountainous areas of Pakistan have suitable weather conditions for growth of vegetation. Alpine and evergreen coniferous forest are two main types. Forest found between 1000-4000 metres elevation are known as coniferous forests whereas the forests above 4000 metres elevation are known as alpine forests.

**Activity Corner!**

Use available source such as maps, google maps or GIS to identify different forests of the world.

**2. Piedmont Forests**

Such forests are located in the foothills. In Pakistan, they are found in Gilgit, Jhelum, Rawalpindi and Kohat districts. Species like Acacia, Wild olive, Phulai, Kahu, Jand and Black berry are found here.

**3. Tropical Thorn Forests**

They are found in dry tropical and semi-arid regions. The main dry hill-forests are in Quetta, Kalat, Zhob and Sibbi divisions where some Chilghoza Pines and Pencil Junipers manage to grow, here.

**4. Riverine Forests**

Riverine forests are located along the rivers. Alluvial soil supports rich crop of acacia, poplar and tamarind. Shisham and babul are another two important trees.

Riverine Forests

**5. Irrigated Plantations**

There are man made forests grown after clearing the warm tropical thorny forests in the areas where canal water is available. A typical example of irrigated plantation is Changa Manga. The other important plantations are there in Chichawatni, Khanewal, etc.

Irrigated Plantations

**6. Coastal Forests**

These forests are located in coastal areas and support a unique coastal mangrove type. Main species found here are Avicennia officinalis.

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## TREES IN NORTHERN AREAS

These are the main forests of Pakistan and lie in Dir, Swat, Chitral and the districts of Rawalpindi and Abbotabad. Rainfall in this region is plentiful. In these forests, evergreen coniferous trees such as Deodar, Firs Blue Pine, Spruce, Chalghoza, Juniper and Chirpine flourish. Their

wood is soft and valuable for building and construction work. Deciduous and broad-leaved trees such as Oak, Chestnut and Walnut are also found on warmer sunnier slopes. Large quantities of fuel wood and resin are obtained from these forests.

**Why the forests of the various regions across Pakistan differ?**

- Vegetation pattern changes with change in altitude.
- Different parts of Pakistan have different soil types.
- Rainfall distribution is uneven in the country. Northern and northwestern mountains receive abundant rainfall. Eastern and western parts of Pakistan are arid or semiarid.
- Temperature is another weather element affecting the type of vegetation and forests. Some trees are resistant to temperature while some are not.
- Slope of the region, quantity of pollens, duration of day for sunlight and pollution are some other factors that have more or less influence on vegetation type.

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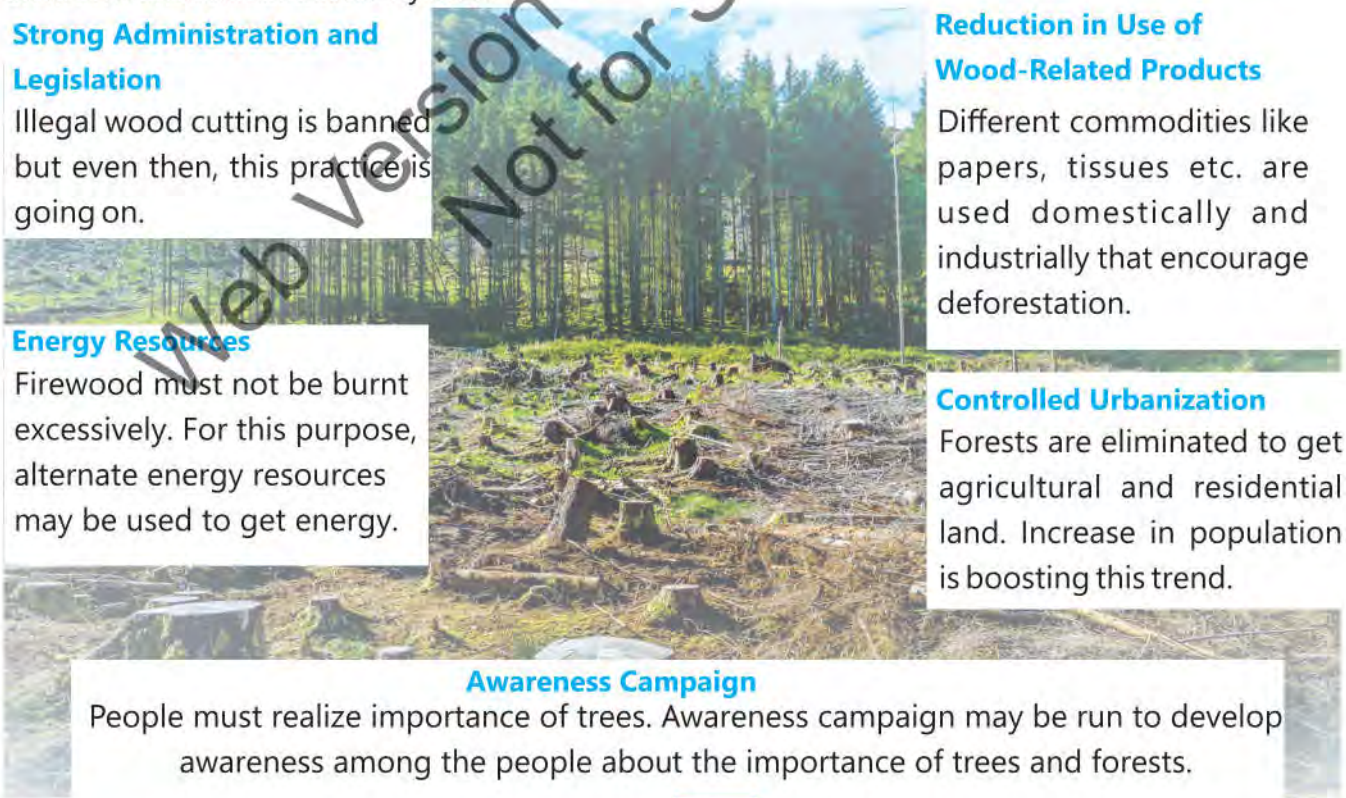
## DEFORESTATION

Ideally, forests must cover 25% area for development of the country. Unfortunately, Pakistan is far below the standard with 5% forest cover. This trend is threatening not only the environment but our economy also.



**Strong Administration and Legislation**

Illegal wood cutting is banned but even then, this practice is going on.

**Reduction in Use of Wood-Related Products**

Different commodities like papers, tissues etc. are used domestically and industrially that encourage deforestation.

**Energy Resources**

Firewood must not be burnt excessively. For this purpose, alternate energy resources may be used to get energy.

**Controlled Urbanization**

Forests are eliminated to get agricultural and residential land. Increase in population is boosting this trend.

**Awareness Campaign**

People must realize importance of trees. Awareness campaign may be run to develop awareness among the people about the importance of trees and forests.

## Key Points

- Agriculture is about growing and harvesting of crops in particular natural and human environment.
- Natural vegetation in any area is greatly influenced by climate.
- Vegetation varies as per climatic conditions.
- Forests situated in equatorial and subequatorial areas between 30° N to 30° S are known as tropical forests.
- Most of the trees in rainforests are hardwoods.
- Temperate forests are situated in temperate areas with annual precipitation ranging from 750 mm to 1750 mm.
- Forests are essential part of the ecosystem.
- Ideally, forests must cover 25% area for development of the country.
- Forests are eliminated to get agricultural or residential land.

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## Exercise

**1 Circle the correct option:**

i. Forests situated in equatorial and subequatorial areas between 30° N to 30° S are known as:

a. Tropical Forests b. Boreal Forests
c. Temperate Forests d. Taiga

ii. Ideally, forests must cover area of:

a. 50% b. 40% c. 25% d. 10%

iii. There are main types of forests:

a. 3 b. 5 c. 7 d. 9

iv. Forests above the height of 4000 meters are:

a. Coniferous b. Alpine c. Riverine d. Rakhs

v. The largest rainforest in the world is:

a. Indus Forest b. Changa Manga c. Amazon Forests d. Alpine Forests

vi. Area of Pakistan is covered by forests:

a. 5% b. 10% c. 25% d. 50%

vii. Zaire Basin is located in:

a. Pakistan b. Europe c. South America d. Africa

viii. Chiltan National Park is located in:

a. Peshawar b. Chitral c. Gwadar d. Quetta

ix. An example of irrigated plantation is:

a. Alpine b. Riverine c. Rakhs d. Changa Manga

x. The tallest trees are found in:

a. Emergent Layer b. Canopy Layer c. Ground Layer d. Understory

## 2 Answer the following short questions:

i. Name any two forests found in the world.

ii. Where temperate forests are located?

iii. How do the forests prevent soil erosion?

iv. Name any three forests in Pakistan.

v. Define deforestation.

vi. Evaluate how do the forests boost economic activities?

vii. Write the difference between agriculture and vegetation.

viii. What do you know about canopy layer of rainforests?

## 3 Answer the following questions in detail:

i. Elaborate different layers of rainforests and discuss the features of each layer.

ii. Name different types of forests in the world. Briefly describe the tropical forests along with characteristics of trees.

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iii. What are the importance of Amazon rainforest?

iv. Discuss role of forests in economy of any country in detail.

v. How are the forests distributed all over Pakistan? Write a comprehensive note.

## Critical Thinking Questions:

- How forest are important for our environment?
- Explore the impacts of northern (Pakistan) forest on the climate of those areas.
- Why forests are different in different areas of Pakistan?
- How we can reduce deforestation in Pakistan?

## Learning Activities:

**The Teacher will:**

i. Visit any forest around you. Observe the trees planted there. Note them in the note book.

ii. Enlist the reason why forests are disappearing.

iii. Explore Changa Manga contribution to the environment of the region.

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Unit 5

# NATURAL DISASTERS

**Student's learning outcomes:**

**After completing this lesson, the students will be able to:**

- Describe the impact of natural disasters on human beings.
- Identify the primary and secondary impacts of natural disasters.
- List down the reasons why developing countries are particularly more vulnerable to natural disasters.
- Explore how global warming (the rising surface temperature of the Earth) can change the frequency and intensity of natural disasters.
- Explain the consequences of human activities, e.g. deforestation, agriculture, urbanization etc. that result in natural disasters.
- Suggest ways that can help to deal with natural disasters.
- Identify the most common natural disaster in Pakistan.
- Sort out multiple ways to preserve natural resources for future generations, including three Rs (Reduce, recycle, reuse).

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"Any natural phenomenon which may cause loss of life and property for man is called natural disaster". Volcanism, landslides, desertification, floods, cyclones, earthquakes and forest fires are such natural phenomena which cause destruction for mankind. Let us have a look on these natural disasters. Some of the examples of natural disasters are given below:

- Earthquakes
- Volcanic Eruptions
- Tsunami
- Landslides
- Floods
- Droughts

Earthquakes

Volcanic Eruptions

Tsunami

Landslides

Floods

Droughts

All of these processes have been operating throughout Earth history, but the processes have become hazardous only because they negatively affect us as human beings.

## IMPACTS OF NATURAL DISASTERS

### Effects of Floods

Floods are the most frequent type of natural disaster and occur when an overflow of water submerges land that is usually dry. Floods are often caused by heavy rainfall, rapid snowmelt or a storm etc.

i. Floods cause damage to the crops.
ii. Floods cause great loss of lives and property.
iii. The floods of 1947, 1988, 2010 and 2022 in different parts of Pakistan caused great loss of lives, property and crops in many parts of the country, particularly in southern Punjab, Sindh, KP, Balochistan, Azad Jammu and Kashmir and in Gilgit Baltistan.

Effects of Flood

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## Effects of Landslides

Sudden or slow movement of soil layer under the influence of gravity is known as landslide.

**i.** Landslides are common phenomenon in mountainous areas which result in blocking of roads.

**ii.** Landslides damage the infrastructures like roads, railway, etc.

**iii.** Landslides may cause loss of property and life.

## Earthquakes

Shaking of Earth crust due to seismic waves is known as earthquake.

**i.** Earthquakes develop cracks in the earth crust that leads to loss of soil, crops and infrastructure.

**ii.** Severe earthquake may cause thousands of casualties.

**iii.** Dams may be cracked in result of earthquake which may lead to flood.

Earthquakes

**Do You Know?**

Earthquakes in Balochistan (1935) and northern areas of Pakistan i.e. Azad Kashmir, Mansehra etc. (2005) demolished the whole city of Quetta and Balakot respectively which led to the death of thousands of people.

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## Volcanism

Eruption of magma from the Earth crust is known as volcanism. It has various effects on humans as follows:

**i.** Hot lava enters in some settlement and destroys everything there e.g. crops, houses, roads and communication system etc.

**ii.** Volcanic activity generates tons of dust and rock particles which causes climatic and environmental disturbances.

**iii.** Volcanism play vital role in formation of certain rocks generally known as igneous rocks.

## Famines and Droughts

Absence of rainfall for a long period in any area is called drought. It causes lack of water for irrigation and soil fertility is lost that emerges in form of food crisis. Famine and drought cause the following effects.

Drought causes Famines

i. Vegetation is dried due to loss of water content which is more vulnerable to forest fire.
ii. Food crisis leads to health problems and casualties.
iii. Economic loss due to droughts causes psychological impacts like depression and anxiety.
iv. Water deficit in result of droughts damages agriculture which may cause economic crisis.

**Example:** The province of Balochistan and Sindh were most badly affected, where 26 districts of Balochistan suffered from severe famine. In Sindh, Tharparkar was the most affected district.

## Hurricanes and Cyclones

A system of high-pressure wind with low air pressure in the center is generally called cyclone and hurricane in some areas of Pacific Ocean as well Atlantic Ocean. Cyclones have following effects on human:

Hurricanes and Cyclones

i. Cyclones bring heavy rainfall.
ii. Cyclones disturb communication and transport systems.
iii. Cyclones may cause damage to crops and vegetation.

## Tsunami

A tsunami is a series of extremely long waves caused by a large and sudden displacement of the ocean, usually the result of an earthquake below or near the ocean floor. It has following effects:

Tsunami

i. Tsunami waves directly hit the coastal areas.
ii. Sailing and voyage in oceans is not possible during tsunami period.
iii. Tsunami damages infrastructures.

**Example:** Indian Ocean faced the severest tsunami in 2004 which hit dozens of South and East Asian countries including Indonesia, Sri Lanka and India. It caused casualties of approximately 225000 people.

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# PRIMARY AND SECONDARY IMPACTS OF NATURAL DISASTERS

Natural disasters have impacts on human life that may be immediate or gradual. So, we classify such impacts into primary impacts and secondary impacts.

## Primary Impacts

Primary impacts are more predictable, sudden and immediate. Natural disasters have following primary impacts:

### 1. Food Scarcity

Crops are vanished, infrastructure is damaged and people are trapped during disasters like landsliding, flood and earthquake. Provision of food to affected people becomes a challenge.

### 2. Damage to Infrastructure

Natural disasters including earthquake, landsliding, flood, volcanism and cyclones demolish infrastructure. Roads, railway lines and buildings are damaged.

### 3. Migration of Population

Population has to migrate from disaster affected areas that becomes a challenge. Provision of life necessities to large number of people is difficult responsibility.

Infrastructure Damage by Earthquake

Shifting of Population after Flood

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## Secondary Impacts

Some long-term impacts of natural disaster can't be predicted earlier. Such impacts are called secondary impacts.

### 1. Environmental Issues

Disasters like floods, volcanisim and droughts create environmental issues at large scale. Fertile soil is flown away so vegetation cover may be lost. Wildlife may have to suffer in result.

### 2. Economic Impacts

Mass migration, damage of communication system, loss of agriculture and livestock and cure of injured people etc. create negative impacts on the economy.

### 3. Water Scarcity

Drainage water supply is blocked due to infrastructural damage after earthquake and landslide. Likewise, water scarcity emerges as a result of droughts because of lack of rainfall. Water scarcity in any case is extremely harmful for livelihood.

Water Scarcity

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## NATURAL DISASTERS AND DEVELOPING COUNTRIES

Different natural hazards hit different parts of the earth regardless of developing or developed countries. Unfortunately, developing countries suffer more than developed countries due to following reason.

**i. Early Warning System:** Scientists have developed different technologies (like weather advisory system, weather watches and flood forecasting system etc.) for prediction of natural hazards but developing countries lack such techniques due to lack of resources, technology, skilled persons and poor management.

**Activity Corner!**

Use available source such as maps, google maps or GIS to identify Earthquake and flood prone areas of Pakistan and how we can mitigate there effects by using modern technology.

**ii. Poor Economy:** Developing countries usually have poor economy. Hence, they have to suffer from long term economic loss. They do not have adequate resources to rebuilt the damaged infrastructure.

**iii. Disasters Resistant Infrastructure:** Developed countries have built infrastructure that is more capable to bear natural disasters, for example, Japan. Developing countries have inadequate resources to build such resilience infrastructure.

**iv. Medical Backwardness:** Developing countries have insufficient medical staff, limited rescue services and traditional health structure that are incapable to cater natural disasters.

**v. Technology:** Satellite and other modern technologies are utilized for disaster prediction. These technologies are quite advance and expensive so developing countries can't afford them due to lack of budget and insufficient skilled manpower.

Dabris flow

Ground subsidence

GPS

Landslide body

Collapse

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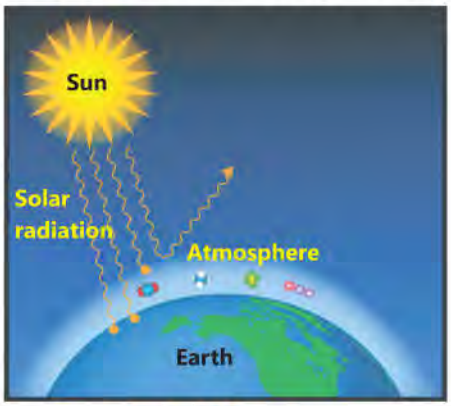
## GLOBAL WARMING AND NATURAL DISASTERS

Nature has developed a protective gaseous envelop around the sphere of Earth. The human activities are responsible for changing the structure and composition of this protective layer. The outcome is gradual increase in terrestrial temperature as a result of human interference in the natural environment is referred to as global warming.

### Causes of Global Warming

The environmentalists enlist the following reasons for global warming.

- The emission of greenhouse gases from the process of combustion as result of commercial, industrial, transportational and domestic activities.
- Deforestation
- Land and air pollution are the other main contributors for increasing the speed and scale of global warming in present times.




Global Warming

## Impacts of Global Warming

Global warming negatively impacts the natural environment by increasing the sea level, glacial melting, floods and droughts, increase in global temperature, prevalence of the health problems among organisms, deforestation and fluctuations in the cycle of precipitation.

Increase in the temperature of earth's atmosphere is called global warming. It is caused by the increase in greenhouse gases i.e. carbon dioxide, water vapors and methane. Relation of global warming with different disasters is as follows:

**Floods:** Global warming is heading towards increased rate of floods due to melting of glaciers and abundant rainfall. **Example:** Pakistan's recent flood (2022).

**Activity Corner!**

How global warming is affecting us?

**Tsunami:** Continental glaciers i.e. Antarctica, Greenland and Siberia etc. are supposed to melt soon. This phenomenon will increase sea level. Earthquake or volcanism inside the sea will result in severe threat of tsunami.

**Cyclones:** Global warming results in increased temperature on equator and severer cold at poles. Difference in air pressure will cause heavy cyclones.

**Drought:** Wetlands, lakes and rivers are drying with the increase in temperature. Water scarcity in any area causes drought. Therefore, global warming is causing droughts in different parts of the earth.

**Heat Waves and Forest Fire:** Droughts evaporate water content from plants. So vegetation cover becomes drier. Heat wave during drought season may lead to forest and bush fires.

**Do You Know?**

Heat wave in Karachi (Pakistan) is results in deaths of many people every year.

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## Greenhouse Effect

Carbon dioxide, water vapours and dust particles absorb the terrestrial heat emission and keep the lower atmosphere warm for leaving things. The process is called greenhouse effect. It keeps the terrestrial temperature suitable at $15^{0}$ celsius for life. The uncontrolled increase in the amount of carbon dioxide, methane, choloroflorocarbons (CFCs) and other harmful gases. This causes air pollution which ultimately promotes the process of global warming and damages the

protective ozone ($O_3$) layer. The industrial revolution accelerate up the carbon emission by increased burning of fossil fuels for industrial and mechanical activities.

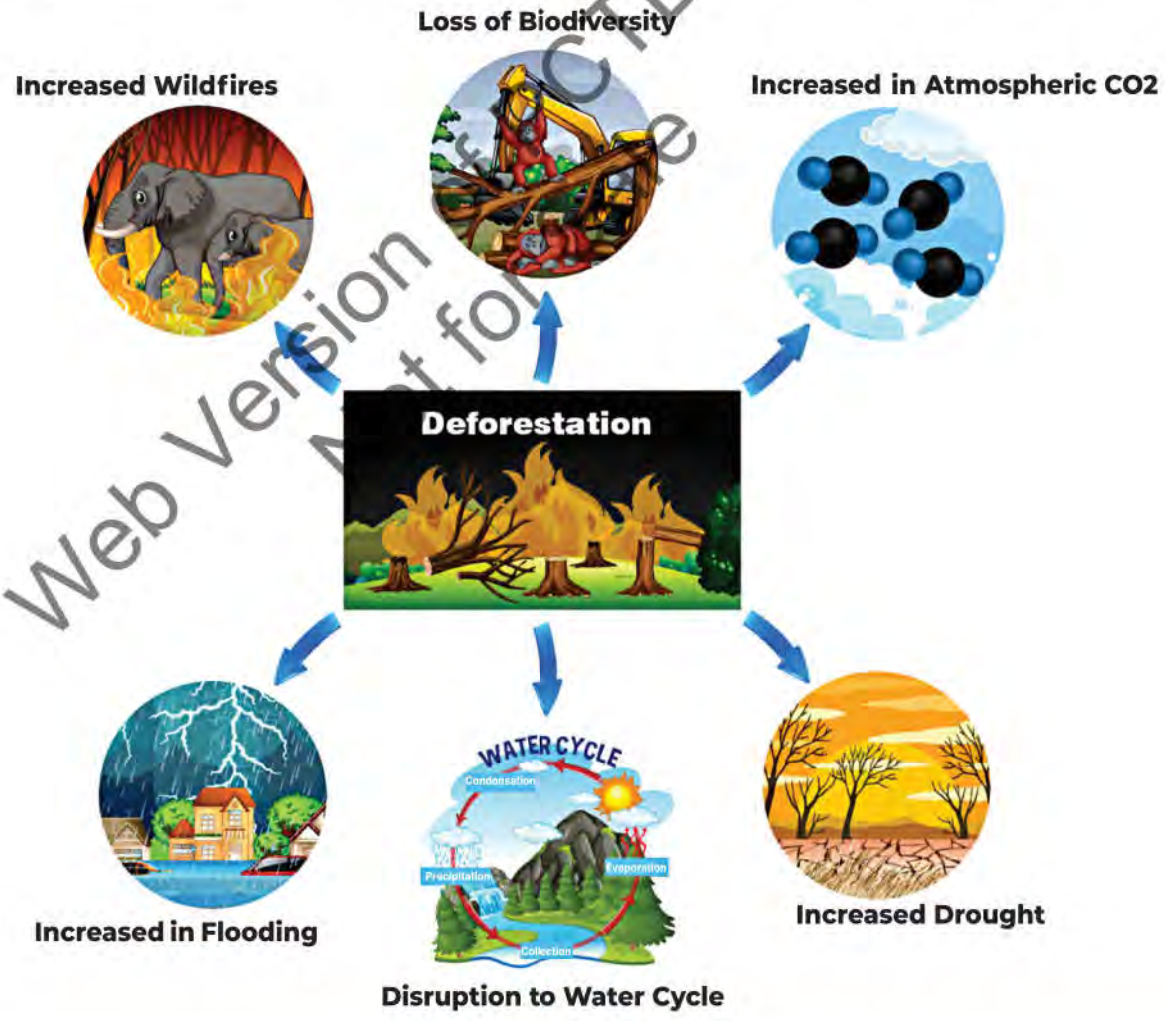
## HUMAN ACTIVITIES AND NATURAL DISASTERS

Human beings are performing different activities on the earth i.e. agriculture, deforestation, urbanization and mining etc. All such human activities cause natural disasters directly or indirectly.

### Deforestation

For an ideal climatic conditions 25% of the country's area must be covered with forests as per international standards. Majority of the countries do not meet this international standard. Unfortunately, even current forest cover is being demolished gradually.

Human beings cut the trees for agriculture, housing societies and other factors. Forests protect topsoil and absorb water. Disappearance of forests is more vulnerable for floods. Deforestation

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leads to environmental pollution as well.

## Urbanization

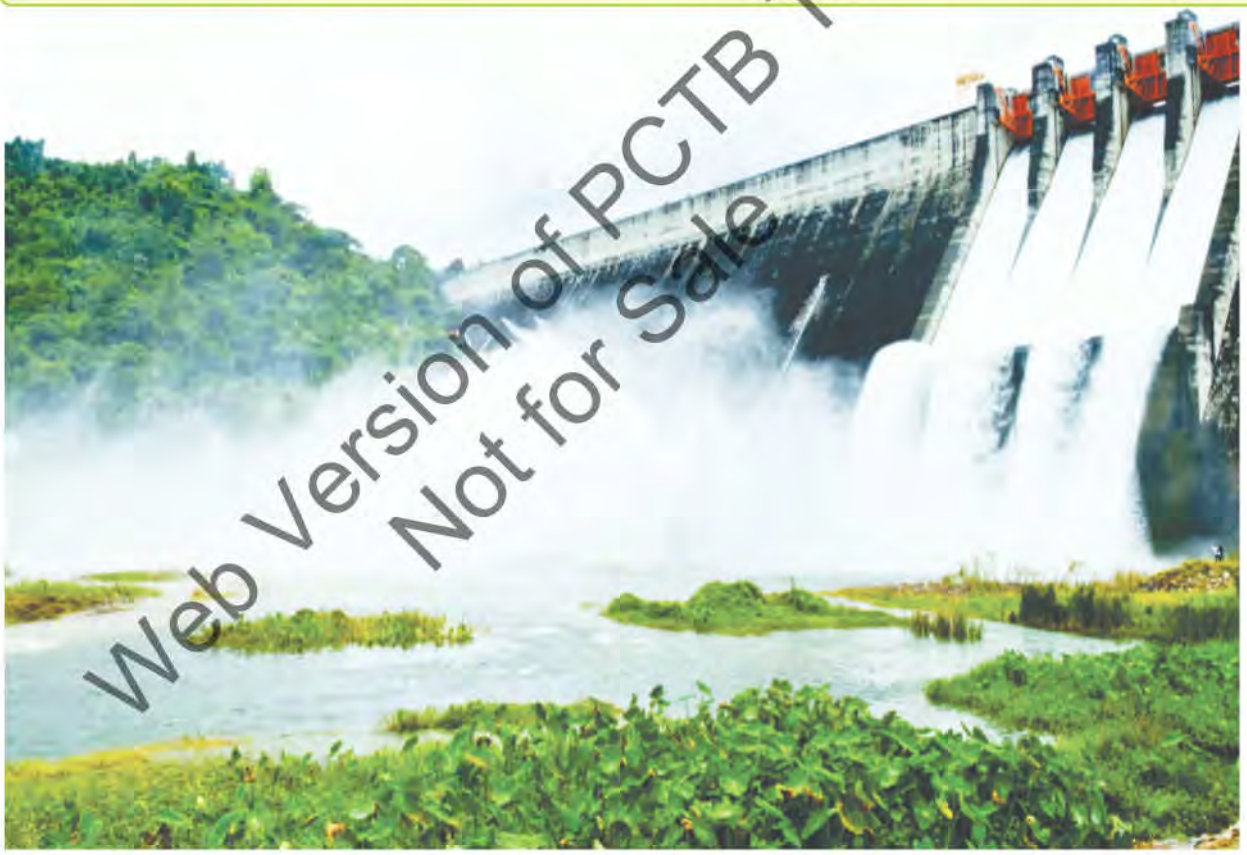
Increase in population of an urban area is called urbanization. Generally, surface in urban areas is cemented. Such materials do not absorb water therefore, rainfall water stands and flows instead of being absorbed which causes urban flooding. Infrastructure is damaged, people are trapped and routine activities are totally jammed in result.

## Construction of Dams

Huge water reserve in dam put extreme pressure on the earth crust that may cause earthquake. Dam failure due to earthquake may cause flooding.

**Do You Know?**

5th June is Celebrated as International Day of Environment



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## Mining

Mining changes landscape permanently. Extraction of minerals through mines weaken the rocks. It may cause landsliding in which huge boulders come downward along the slopes. Same situation emerges when mines are collapsed.

## Pollution

The addition of contaminants in atmosphere is called pollution. Human activities like deforestation, urbanization, transportation and industrialization etc. are causing pollution. Resultantly, acid rain occurs that weaken chemical rocks. It may result in landslide.

## Agriculture

Soil fertility is lost gradually after continuous cultivation. Topsoil is destroyed and tends more towards soil erosion. It may result in landslide in mountainous areas and desertification in plain areas.

# THE MOST COMMON NATURAL DISASTER IN PAKISTAN

An overflow of river water out of its channel, which may cause damage to the near by settlements is called flood. It is considered a natural disaster because it may be a cause of social and environmental degradation.

Indus is the largest river in Pakistan. Eastern and western tributaries of Indus constitute a comprehensive drainage system that is quite useful for agriculture. Hence, Pakistan is considered as an agricultural country.

All of these rivers are irrigated by meltwater from the glaciers,monsoon rainfall and cyclonic rainfall. Global warming and changing in rainfall pattern are affecting Pakistan. Therefore, flood is the most occurring natural disaster in Pakistan.

## Causes of Floods in Pakistan

**i.** Rainfall is not well distributed throughout the year in Pakistan. Some of rain-water is absorbed by the ground whereas most of it rushes to the low-lying areas. When the water reaches the rivers, it overflows their banks causing floods.

**ii.** The Indus and its tributaries rise in the snow-clad mountains. Snow at these mountains starts to melt in summers and sometimes rivers receive exceptionally large amount of water and start overflowing.

**iii.** During summers, monsoon winds cause heavy rainfall on highlands. Hence, rain-water reaches the rivers quickly particularly in the plains and flooding adjacent areas.

**2011 Floods damages to Agriculture**

As per the details released by economic survey of Pakistan (2011-2012), the total loss estimated is US$1840.3 million of which 89% is the form of direct damage and 11% in the form of indirect loss. Sindh suffered 94% and Balochistan 6 % of the total damage. Kharif crop accounted for 91.5% of the damages and following Rabi crops of 2011 and 2012 also suffered indirect damage.

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## Measurements of Flood Control

i. A flood control department has been set up by the government of Pakistan.
ii. Sides of the rivers are cemented so that water cannot overflow in surroundings.
iii. Bridges are built to protect roads and railway lines.
iv. Government establishes relief camps to help victims (for providing shelter, food and medical facilities etc.).
v. Forecasting system may be updated, and dams should be constructed.
vi. Forests are being planted along rivers and roads to control flood water.

## Preservation of Natural Resources

The world is blessed by different natural resources i.e. minerals, forests, water, wildlife and rich soil. All these resources have to be managed in a way to prevent further environmental destruction and to maintain Ecosystem and to minimize over consumption of natural resources. Following steps should be taken for preservation of natural resources:

- Three Rs (reduce, recycle and reuse) technique is the best way to preserve natural resources.
- Construction of water reservoirs (dams) with advanced techniques to preserve water for future.
- Switch to other renewable energy resources e.g. solar energy, wind energy or biogas etc.
- Plastic bottles, tins, waste papers and other items may be recycled to get some other output.
- Irrigation system should be improved by using modern irrigation techniques.
- Awareness campaign must be run among public against illegal hunting, wastage of water, deforestation and environmental pollution.
- Water recycling plants may be installed for preservation of water.

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# STRATEGIES FOR REDUCTION OF ENVIRONMENTAL POLLUTION

The following strategies may prove fruitful for reducing the level of environmental pollution. Proper disposal of waste material, cleanliness, minimizing the use of plastic bags, optimal use of energy resources, promotion of green values in daily life, promotion of plantation and awareness about the environment and our responsibilities towards environmental protection are keys to protect and keep our environment green and clean for all forms of life.

**Do You Know?**

Smog is air pollution that reduces visibility. The term "smog" was first used in the early 1900s to describe a mix of smoke and fog.

## Key Points

- 25% area of the country must be covered with forests for ideal climatic conditions.
- Greenhouse effect is increasing in atmosphere day by day due to human activities.
- Floods, tsunamis, cyclones, earthquake etc. are some examples of natural disasters.
- Floods cause damage to the crops as they bring vast areas of land under water.
- Sudden or slow movement of soil or rocks falling under the influence of gravity is known as landslide.
- Heavy winds carrying abundant sand particles with them are named as dust storms.
- Shaking and jerking of earth crust due to seismic waves is known as earthquake.
- Addition of harmful elements in the biosphere is called environmental pollution.
- Eruption of magma from earth crust or mantle is known as volcanism.
- Absence of rainfall for a long period in any area is called drought.
- Indian Ocean observed the severest tsunami in 2004.
- Drainage water supply is blocked due to infrastructural damage after earthquake and landslide.
- Developing countries have insufficient early warning systems of natural hazards.

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## Exercise

**1 Circle the correct option:**

i. Overflow of water from rivers is called:

a. Rainfall b. Flood c. Tsunami d. Snowmelt

ii. Result of absence of rainfall for a longer period of time is known as:

a. Pollution b. Earthquake c. Heatwave d. Drought

iii. World Environment Day is observed on:

a. 5th June b. 5th December c. 5th August d. 5th February

iv. Area of the country must be covered with forests:

a. 10% b. 15% c. 25% d. 50%

v. The most common natural disaster in Pakistan is:

a. Rainfall b. Flood c. Tsunami d. Snowmelt

vi. A City was demolished due to earthquake in Balochistan (1935):

a. Quetta b. Karachi c. Balakot d. Islamabad

vii. Landsliding occurs mostly in:

a. Mountainous Areas b. Plain Areas c. Coastal Areas d. Dry Areas

## 2 Answer the following short questions:

i. Define natural disasters.
ii. Write any three impacts of drought.
iii. Write the primary impacts of natural disasters.
iv. How does global warming cause natural disasters?
v. What is meant by natural disasters?
vi. What is meant by three Rs (reduce, recycle, reuse)?

## 3 Answer the following questions in detail:

i. What do you know about natural disasters? Write the effects of any three natural disasters in detail.
ii. Why are natural resources to be preserved? What measures can be taken for preservation of natural resources?
iii. Which types of human activities are responsible natural disasters?
iv. Global warming is causing increase in frequency and magnitude of natural disasters. How will you justify this statement?

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## Critical Thinking Questions:

- Why developing countries are the most affected by the natural disasters?
- Explore the impacts of rising temperature on our environment.
- Why floods are occurring frequently in Pakistan?
- How we can preserve our resources?

## Learning Activities:

**The Teacher will:**

i. Identify on the map of Pakistan, which areas are vulnerable to different types of disasters.
ii. Investigate reasons why temperature is rising and discuss with class fellows.
iii. Analyze how technology can help in mitigating the effects of natural disasters, show through charts.

## Project for Students:

- Make a chart of 3Rs and its applications in our daily life.

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Unit 6

# CHANGING EARTH AND HUMAN ACTIVITY

**Student's learning outcomes:**

**After completing this lesson, the students will be able to:**

- Describe the processes of weathering and erosion.
- Identify the types of erosion (wind and water).
- Explain the four processes of coastal erosion.
- Explain the effect of the processes of coastal erosion on landforms.
- Explain erosion caused by human activities on the Earth.

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The Earth's surface is not uniform. The process of making and breaking of rocks continues due to different factors. Soil erosion, land sliding and mud flow, etc. are some examples of rocks disintegration.

## WEATHERING

**The decay and decomposition of rocks by different mechanical, chemical and biological process is called weathering.** In other words, mechanical disintegration and chemical decomposition of rocks that destroy their coherence, and breaks them into smaller components/fragments is called weathering.

In this process, the debris (material) is not transported but remains there at their place. This process depends on weather elements like sunlight and precipitation (rainfall or snowfall). Gases in the atmosphere, frost, vegetation and animals are some other agents of weathering. There are three types of weathering.

**i.** Physical or Mechanical Weathering
**ii.** Chemical Weathering
**iii.** Biological Weathering

### i. Physical or Mechanical Weathering

In this process, rocks expand in summers due to heat and shrinks in winters. This continuous process of expansion and compaction of rocks

Mechanical Weathering

weakens and eventually disintegrate the rocks without changing its chemical composition. This process of weathering is mostly found in dry and cold areas.

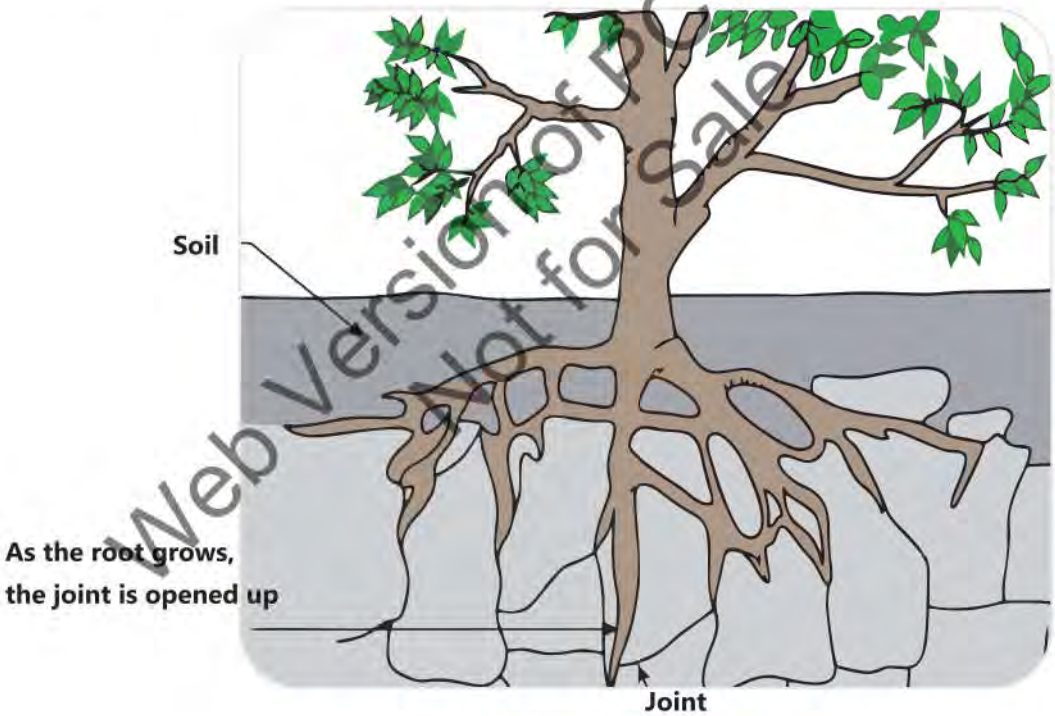
Chemical Weathering

### ii. Chemical Weathering

Rocks are an aggregate of minerals. These minerals face chemical changes as they are affected by water, oxygen($O_2$) or carbon dioxide($CO_2$). These changes weaken the rock and eventually lead to their disintegration.

### iii. Biological Weathering

Weathering due to living organisms on the Earth's surface is named as biological weathering. It is performed by plants and animals. Plants roots reach the joints and cracks of rocks as they grow up which ultimately exert pressure on rock layers. Therefore, rocks are disintegrated.




Biological Weathering

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## EROSION

Sometimes, broken material in result of weathering is transported by some agents which is known as erosion. These agents may be rivers, glaciers or winds, etc.

**Activity Corner!**

- Rivers have clean water in mountainous areas. This water becomes dirty and muddy in plain areas. Why does this happen?
- Use available source such as maps, google maps or GIS to understand the process of weathering and erosion and causes of Rock weathering.

## TYPES OF EROSION

Rivers, glaciers and wind are the agents of erosion. They are continuously doing their work and make different types of landforms on the Earth surface.

### Wind Erosion

Wind is also an important agent of erosion. It works notably in arid and semi-arid areas i.e. Balochistan in Pakistan. Wind works in two different ways.

#### 1. Erosional Landforms Made By Wind

Wind performs erosional work in two ways. Firstly, it carries unconsolidated sediments with it. This process is called **deflation**. Secondly, it uses these sediments as tool for further erosion. This process is called **abrasion**. Following are some important erosional landforms:

**i) Zeugen**

Sometimes hard rocks underlain by soft rocks are present on the surface of Earth. Wind erodes the lower layers of soft rocks as compared to the hard rocks. As a result, the soft rocks become thin and hard rocks remain above these soft rocks in the form of slabs. This landform is called zeugen.

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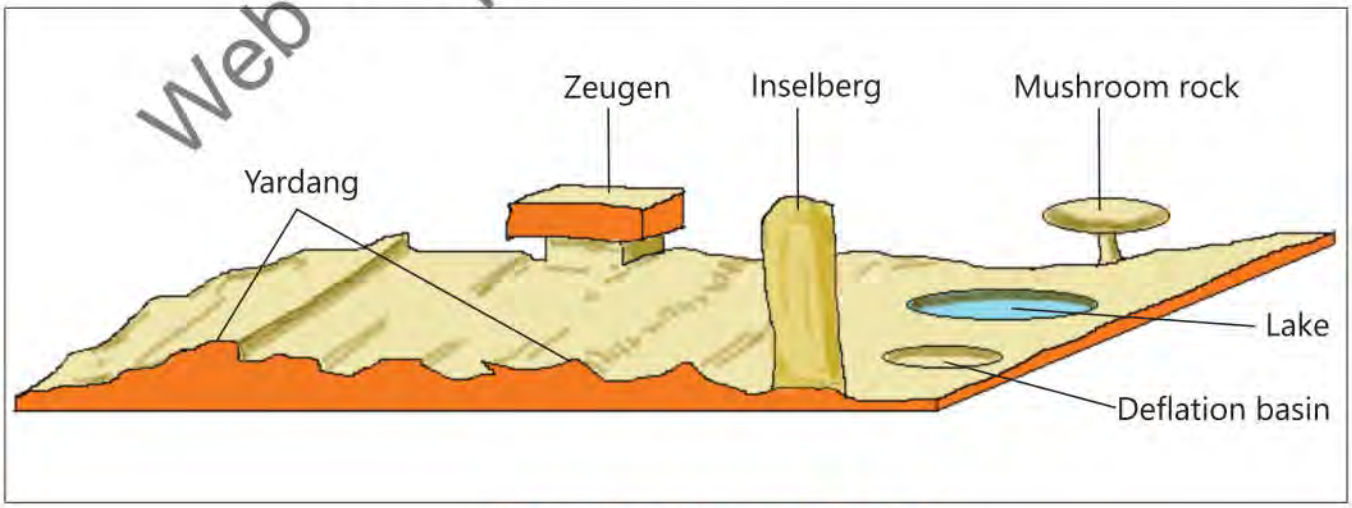



Erosional landforms made by wind

**ii) Mushroom Rock**

Further erosion of zeugen transforms the hard rocks into mushroom shaped rock residing over thinner soft rocks.

**iii) Deflation Basin and Lakes**

When wind picks and carries loose sediments, shallow depressions are formed on the Earth's surface. These are called deflation basins. When rain water accumulates in these depressions, they become lakes which evaporate with the passage of time.

**iv) Yardang**

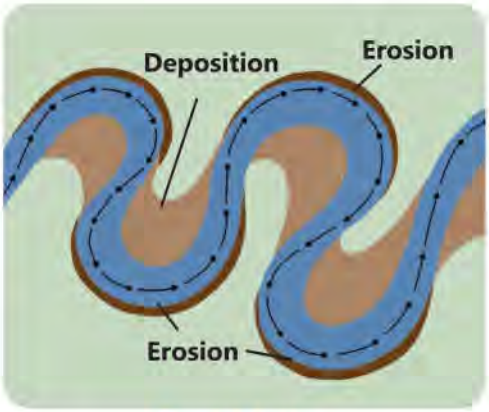
Sometimes a series of hard and soft rocks is present side by side on the Earth's surface. Uneven erosion of wind transforms these rocks in irregular shapes, which are called yardangs.

**v) Inselberg**

When soft rocks are eroded completely by wind, columns of hard rocks remain behind at distant places. These are called inselbergs.

## Water Erosion

River carries the disintegrated material with its flow and cuts the rocks with the help of that debris. This process is known as fluvial erosion.



Fluvial Action

### 2. Landforms Made By River/Water

River is an important agent of landform change. Permanent rivers are found in those areas which receive ample rainfall regularly. Presence of mountains provides initial slope for the flow of surface water in small channels. These tiny channels join to form a river. A river after its creation, performs three types of geologic works. It breaks the rocks coming in its way. This act is called **erosion**. It transports the eroded material. This act is called **transportation**. It deposits the eroded material when its speed is very low. This act is called **deposition**. River creates the following landforms by erosion.

**i) V-Shaped Valley**

In mountains, the valley of the river gets deeper due to downward erosion and attains the shape of English alphabet 'V', this landform is called V-shaped valley. Very deep valleys are often called 'Gorges'. Such valleys are found in northern areas of Pakistan.

**ii) Waterfall**

River bed may contain hard and soft rocks. Sometimes soft rocks are found beneath the

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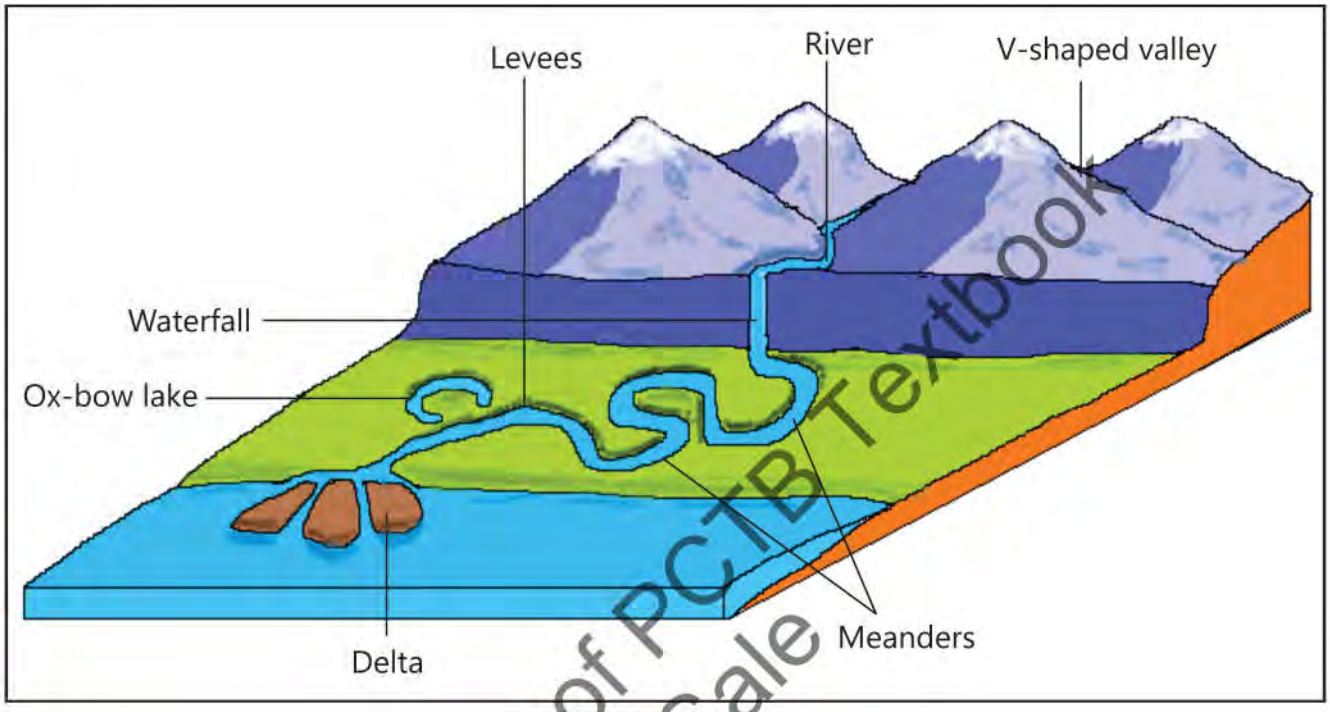
bed of hard rocks. When the river cuts the upper layer of hard rocks on the bed, it tends to erode the lower soft rocks to a great depth. This act causes the fall of water in the form of sheet called waterfall.




Landforms made by river

**iii) Pot Holes**

Sometimes the swirling action of stones in the water develops holes in the river bed. These are called pot holes.

**iv) Meanders and Ox-bow Lake**

Occurrence of hard and soft rocks in the river's channel results in the creation of a winding path due to uneven erosion of the river, these are called meanders. Sometimes river after cutting the outer bends of the meanders attains a straighter channel, leaving behind a crescentic lake at the side. This lake is called ox-bow lake. Kalery lake on river Indus is an ox-bow lake.

**Skill**

Which type of weathering occurs in Pakistan and how human activities are changing the landforms?

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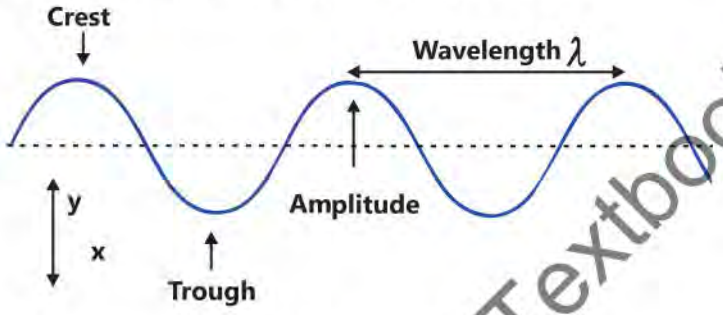
## PROCESSES OF COASTAL EROSION

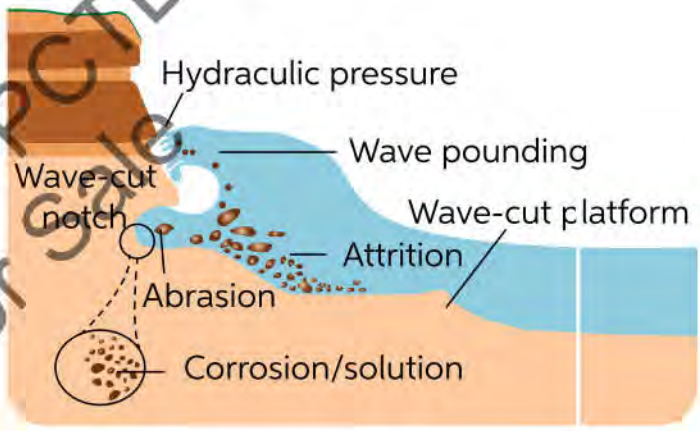
Seawater flows in the form of waves. These waves collide with coasts. Process of erosion and deposition occurs during this collision. Upper part of the wave is called crest and lower part is trough. Distance from crest to crest or trough to trough is named as wavelength whereas vertical distance between crest and successive trough is called amplitude.




Following four types of processes are involved in coastal erosion.

### Corrasion

Continuous process of throwing the material carried by waves starts to erode the coast gradually. This process is named as corrasion or abrasion.




### Attrition

The material carried by waves collides mutually. Eventually, material starts to break down into smaller pieces and becomes rounded and smoother over time. This process is called attrition.

### Solution

Seawater is saline. Eroded material carried by waves reacts with mineral particles in the water and is dissolved. Such eroded coast is weakened. Process of weakening the coast in such way is called solution.

### Hydraulic Action

Seawater enters in the rocks through cracks and joints. Inside, air is trapped and compressed by water. Pressure exerted by water and air within cracks widens the cracks. Repeated expansion and compression breaks coastal rocks into smaller pieces. This process is known as hydraulic action.

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## Landforms Made By Coastal Erosion

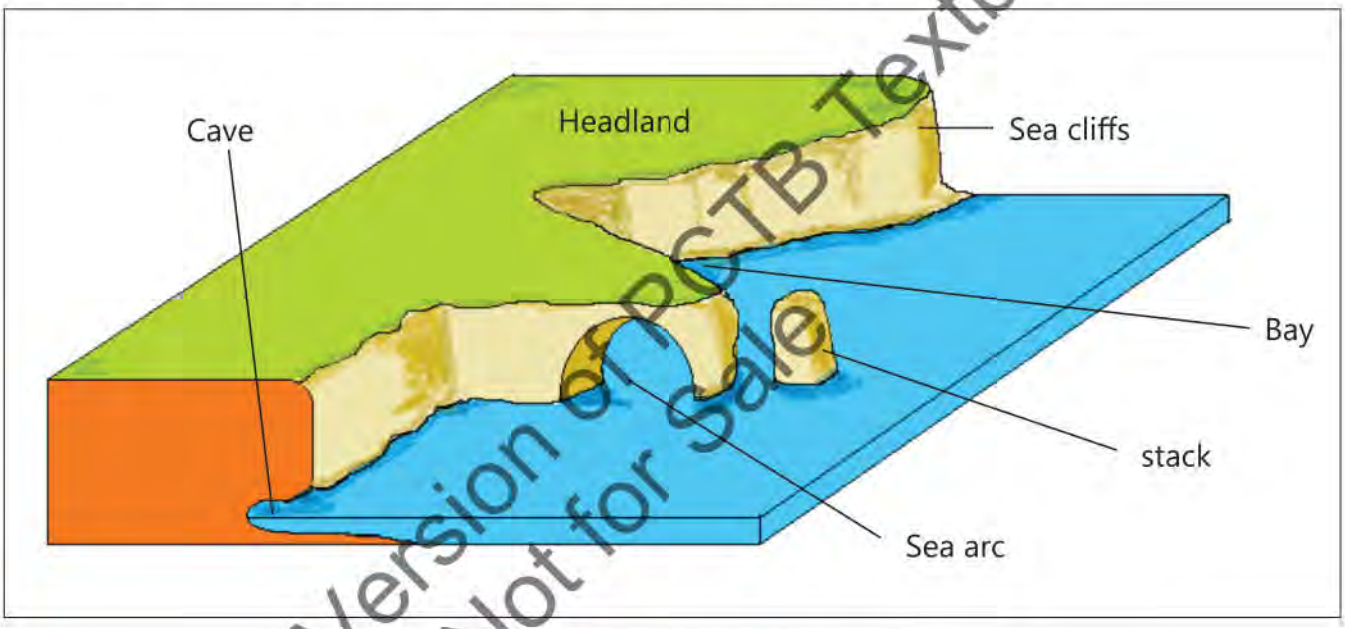
Waves of the river tend to erode inland areas whereas sea waves are an important source of landform change in the coastal areas on a larger scale.

**i) Caves**

Continuous wave attack at the bottom of cliffs creates cavities. These cavities by further erosion transform into caves.

**ii) Headland and Bay**

Sometimes, sea water invades farther inland the Earth creating a bay. While the bordering land comprised of hard rocks remains well ahead in water. This is called head land.




Erosional landforms of sea waves

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**iii) Sea Arch and Stacks**

Sea waves strike the head land from both sides. This continuous erosion results in creating an opening in the head land. This landform is called sea arch. When the sea arch is detached from the headland by further erosion, the remaining column like structures are called stacks. The landform made by sea waves can be seen in coastal areas of Pakistan especially at Hoxbay.

**iv) Sea Cliffs**

On mountainous coasts, seaward slopes are exposed due to wave attack. With the passage of time the slopes retreat and become perpendicular. These are called cliffs. The rate of retreat depends upon the nature of the rocks.

**Beaches**

Material carried by seawater is deposited on land surface along the coast which forms a beach. Fine material e.g. clay is deposited near the sea while coarser materials e.g. pebbles are deposited further inland.

**Spit and Tombolo**

Spit is a narrow but long ridge of deposited material extending from mainland into sea. If spit is connected to any island, it forms a feature known as tombolo.

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## HUMAN ACTIVITIES AND EROSION

There are several causes of erosion by human activities. Out of them major ones are construction, gardening and mining etc.

### Deforestation

Deforestation is a way in which humans cause erosion. Removal of the vegetation covering the ground causes the soil to erode which is unprotected against wind and water.

Deforestation

## Watering

Watering to gardens and lawns also causes erosion. Water hits the ground with enough force while using a pipe for watering which results in erosion.

## Agriculture

Agriculture is the major factor of soil erosion. When vegetation is cultivated in the soil/ground, the top soil is shifted, which causes erosion.

## Mining

Mining is an important sector of economy but Earth's surface is exploded for mining. Rock particles are eroded in this way.

## Construction

Most of the buildings have basements. Deep digging of the Earth to construct buildings, wells or underpasses etc. also causes erosion.

Mining

Construction

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## Air Pollution

Emission of greenhouse gases into the atmosphere due to human activities are causing air pollution. Acid rain due to air pollution results in chemical weathering.

**Activity Corner!**

**Name some features made by each type of erosion?**

| Fluvial | Aeolian | Coastal |
|---|---|---|
| | | |
| | | |
| | | |

## Key Points

- Disintegration of rocks into smaller particles is known as weathering.
- Process of weathering is mostly seen in dry and cold areas.
- Weathering due to living organisms on the Earth surface is named as biological weathering.
- Coastal rocks are weakened because of continuous collision of waves.
- Material carried by seawater is deposited on land surface along the coast which forms a beach.
- Acid rain due to air pollution results in chemical weathering.

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## Exercise

**1 Circle the correct option:**

i. A circular and small part of the sea is called:

a. Wave b. Arches c. Bay d. Lagoon

ii. Types of weathering are:

a. 2 b. 3 c. 4 d. 5

iii. Upper part of the wave is called:

a. Wavelength b. Amplitude c. Trough d. Crest

iv. Rock Eroded from base due to aeolian work is called:

a. mashroom Rock b. Metamorphic Rock

c. Sedimentary Rock d. Organic Rock

v. The most arid province of Pakistan is:

a. Punjab b. Balochistan c. Sindh d. K.P.

vi. Weathering due to living organisms is known as:

a. Biological Weathering
b. Chemical Weathering
c. Physical Weathering
d. Erosion

## 2 Answer the following short questions:

i. Define weathering and erosion.
ii. Write the names of any four landforms made by coastal erosion.
iii. What do you know about chemical weathering?
iv. Differentiate arches and stack.
v. Define wind erosion.
vi. Enlist the agents of weathering.

## 3 Answer the following questions in detail:

i. Discuss different landforms formed by coastal erosion.
ii. What are the different types of weathering? Explain each of them.
iii. Elaborate the difference between water erosion and wind erosion.
iv. Evaluate the role of human activities in erosion of land.

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## Critical Thinking Questions:

- How weathering and erosion are important in formation of soil?
- How we may stop deforestation?
- Why our coastal areas are polluting?

## Learning Activities:

**The Teacher will:**

i. Visit any stream or river. Do you find some similarities in the features made by stream/river and coastal waves.
ii. Evaluate the use of land in Pakistan is sustainable or not.
iii. Enlist difference between weathering and erosion.
iv. Evaluate the impact of land clearing to grow agriculture.

## Project for Students:

- Make a model of landforms made by river.

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# GLOSSARY

| | | | |
|---|---|---|---|
| **Altitude** | Height, mostly measured from sea level | **Landform** | The natural surface features on the Earth |
| **Amazon** | A region in continent South America, stretched mostly in Brazil | **Rift Valley** | Narrow valley formed by internal movements of the Earth |
| **Boreal Forests** | Known as Taiga forests mostly found in northern part of the world | **Rock Cycle** | Transition of rock types from one phase to another |
| **Climate** | Long term atmospheric conditions in any area | **Sial** | A layer in earth crust comprised of silicon and aluminum |
| **Core** | Inner most part of the Earth | **Sima** | A layer in earth crust comprised of silicon and magnesium |
| **Crust** | Outer most and solid part of the Earth | **Tectonic Plates** | Irregular shaped slabs of rocks floating at magma |
| **Crest** | Upper part of the wave | **Tropical** | The areas between equatorial and temperate region |
| **Faults** | Cracks in the crust | **Temperate** | The areas lying at $23.5^0$ latitudes in both hemispheres |
| **Galiyat** | Mountainous region in the surroundings of Murree (Pakistan) | **Weather** | Short term atmospheric conditions in any area |
| **Infrastructure** | Physical structure constructed for operations of a society | **Weathering** | Disintegration of rocks |

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